

2015

Canfor Forest Management Plan



Canadian Forest Products Ltd.

Grande Prairie Division

FMA # 9900037

May 1st, 2015

Revised: November 30th, 2015

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2015 Forest Management Plan for Canadian Forest Products FMA #9900037

Prepared by:

A handwritten signature in black ink, appearing to read "Melonie Zaichkowsky".

Melonie Zaichkowsky, RPF
Forestry Supervisor



Reviewed by:

A handwritten signature in blue ink, appearing to read "Jon Taszlikowicz".

Jon Taszlikowicz
Operations Manager

Validated by:

A handwritten signature in black ink, appearing to read "Dwight Weeks".

Dwight Weeks, RPFT
Strategic Planning Coordinator



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Phone: 780 805 3820 Fax: 250 428 5098
Suite 900
10665 Jasper Avenue
Edmonton, AB Canada T5J 3S9

April 27, 2015

Mr. Robert Popowich
Senior Manager, Forest Resource Management
Forest Resource Management Section
Environment and Sustainable Resource Development
7th fl Great West Life Building
9920 - 108 Street
Edmonton, AB
T5K 2M4

Re: Canfor Detailed Forest Management Plan, May 1, 2015

Mr. Popowich:

Tolko supports Canfor's Detailed Forest Management Plan (DFMP) as submitted on May 1, 2015 contingent on ESRD approval of the preferred forest management strategy based on run Sa63b.

PFMS Run Sa63b meets Tolko's DTA AAC requirement of 282,529 m³ and the agreed to carry forward volume of 1,038,930 m³. The total Tolko deciduous volumes in run Sa63b for the first ten years are 2,994,618 m³ from pure deciduous stands and 869,602 m³ secondary deciduous for a total of 3,864,220 m³.

We also expect that ESRD approval will direct Canfor to develop a strategy to provide Tolko access to deciduous stands with a conifer understorey prior to the next DFMP submission in 2025.

We appreciate the opportunity to participate in the development of Canfor's DFMP. If you have any questions I can be reached at 780 805-3820 or Tim.Gauthier@tolko.com.

Sincerely,

Tim Gauthier
Woodlands Manager, Forestry

Cc: Jennifer Koch, ESRD
Dwight Weeks, Canfor
Melonie Zaichkowsky, Canfor
Fred Radersma, Norbord

www.tolko.com





Ainsworth Engineered Canada LP

Bag 6700
Highway 40
Grande Prairie, Alberta
Canada T8V 6Y9
780 831 2500 Telephone
780 831 2501 Fax
info@ainsworth.ca

www.norbord.com

April 30, 2015

Robert Popowich
Senior Manager, Resource Management section
Forest Management Branch
Environment and Sustainable Resource Development
7th Floor, Great West Life Building
9920-108 Street
Edmonton, Alberta
T5K 2M4

Re: Canfor's 2015 Detailed Forest Management Plan

Dear Mr. Popowich:

Norbord is in support of Canfor's Detailed Forest Management Plan (DFMP) scheduled for submission on May 1st of this year. Norbord has participated in the development of the DFMP and has appreciated the opportunity.

The Preferred Forest Management Scenario (PFMS) run Sa63b meets Norbord's requirements. In summary, run Sa63b reflects Norbord's current Annual Allowable Cut (AAC) of 170,000 m³ and provides for a carry forward volume of 7,877 m³/yr with a total 10 year allocation volume of 1,778,770 m³.

One item that, through the period of development of the DFMP, has been discussed but still requires efforts to finalize is the request by Norbord to access the deciduous resource in the deciduous stands with coniferous understory. A large volume of the deciduous resource is currently inaccessible and will be lost unless harvested. Norbord is confident in its ability to operate in these stands through past practices, removing the deciduous resource, while protecting the coniferous understory.

If you have any questions or concerns I can be contacted at 780-831-2516.

Regards,
Norbord Inc.

Fred Radersma RPF
Woodlands Manager Alberta

Cc: Melonie Zaichkowsky, Canfor
Dwight Weeks, Canfor
Jennifer Koch, ESRD
Tim Gauthier, Tolko

Executive Summary

This Forest Management Plan (FMP) has been prepared in accordance with paragraph 10 of Forest Management Agreement 9900037 (GoA, 2015b). This plan will be updated every ten years, or sooner if significant developments occur that impact current forest management strategies. It outlines the goals, objectives, and strategies that Canadian Forest Products Ltd. (Canfor) and other forest companies operating on the Forest Management Agreement area (FMA area) will employ in the management of the forest resource.

Supplemental to rights granted to Canfor with respect to coniferous timber, Deciduous Timber Allocations (DTA) for Norbord Inc. (DTAG150003) and Tolko Forest Industries Ltd (DTAG150001 & DTAG150002) are embedded in the FMA area. This FMP was developed in cooperation of the three forest companies, and although the companies operate under different business principles and markets, integration is fundamental to the successful management of the forest resource towards the future modeled forest within the FMA area.

Public involvement is a primary principle used in the development of the FMP and Canfor's Forest Management Advisory Committee (FMAC) was integral in the planning process. Canfor's *2012 Sustainable Forest Management Plan* (SFMP), developed and approved under the Canadian Standards Association (CSA) Sustainable Forest Management System Standard CAN/CSA Z809-08, was aligned as closely as possible with Annex-4 of Alberta's Forest Management Planning Standard and is included as an appendix in the FMP. Through the process of public participation, the SFMP attains local relevance in the form of locally determined Values, Objectives, Indicators, and Targets (VOITs).

The FMP reflects the principles of *Canfor's Sustainable Forest Management Commitments-May 2012*, which broadly outlines Canfor's commitment to sustainable forest management, accountability, adaptive management, science, multiple value management, health and safety, Aboriginal people, opportunities for participation, defining objectives over temporal scale, continuous supply of timber resources, and maintenance of forest landbase in all of the forests Canfor operates. These commitments will maintain long-term health of forest ecosystems, while providing ecological, economic, and social opportunities for the benefit of present and future generations.

Canfor has adopted and modeled principles pertaining to the Natural Range of Variability (NRV) in this FMP. The natural range of variability refers to the range or variation in ecosystems as observed over a period of time. NRV ensures that a greater degree of ecosystem sustainability can be achieved by emulating similar disturbance patterns that would naturally occur on the landscape in historic pre-fire suppression conditions.

The FMP provides direction in the sustainable management of the associated forest landbase over a 200-year planning horizon, while providing guidance for operational activities over the term of the plan. The content and structure of this plan are compatible with the *Alberta Forest Management Planning Standard- ver 4.1* (2006). The FMP includes:

- A detailed description of the Forest Management Agreement area;
- A predictive forest growth Timber Supply Analysis (TSA);
- A Preferred Forest Management Scenario (PFMS) providing future direction for operations on the landbase and consideration to non-timber values (boreal caribou, watersheds, natural disturbance, etc.);
- A Spatial Harvest Sequence (SHS) outlining the spatial polygons associated with the plan and utilized in development of operational plans;
- An Annual Allowable Cut (AAC) for both coniferous and deciduous tenure holders;
- A Reforestation Strategy for the FMA area that will be implemented to meet the TSA yield projections; and
- A list of VOITs derived from the Alberta Forest Management Planning Standard and Canadian Standards Association (CSA) Sustainable Forest Management System Standard that provide measureable targets for performance monitoring and reporting.

The FMP will be implemented through adaptive management, which makes provisions for changes plans based on a process of scientific evaluation, monitoring, assessment and feedback. Monitoring and forest stewardship reporting are an important component of this FMP. Sustainable forest management rests on Canfor's ability to predict, to some degree, the future forest conditions. Monitoring provides the necessary feedback on those predictions, and supports adaptive management. Through monitoring and stewardship reporting, data will be collected to learn more about the forest which will subsequently lead to improved forest management strategies and forest resources.

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1 Introduction

On May 26, 1964, Canadian Forest Products Ltd. (formerly North Canadian Forestry Industries Limited) entered into a 20-year Forest Management Agreement (FMA) with the Province of Alberta. This Agreement was renewed in 1978 and again in 1999. The current Forest Management Agreement 9900037 commenced on May 1, 2015 (Appendix A).

The FMA agreement grants Canfor the rights to establish, grow, and remove coniferous timber within the Forest Management Agreement area (FMA area), currently comprised of 644,695ha (Figure 5). The FMA area is the primary source of coniferous timber for Canfor's Grande Prairie sawmill.

As per subparagraph 10(1) of the FMA agreement, a Forest Management Plan (FMP) must be submitted to the Minister by May 1, 2015. The FMP describes the activities in a specific geographic area and time period, and provides detailed justification and sustainable forest management planning to support the AAC for both coniferous and deciduous species on the FMA area.

Two deciduous companies, Norbord Inc. and Tolko Industries Ltd., have been allocated deciduous timber within the FMA area. Both companies played an integral part in the development of the FMP by providing editorial and technical input regarding strategic and operational plans, resource and timber supply analysis, growth and yield projections, and harvest sequencing.

All coniferous and deciduous operators in the FMA area will conduct their activities in accordance with this plan.



2 Background Information

2.1 Canfor Corporation and Grande Prairie Division History

2.1.1 CORPORATE OVERVIEW

Canfor Corporation is a leading Canadian integrated forest products company based in Vancouver, BC with interests in Canada (Alberta and British Columbia) and the United States (North Carolina, South Carolina, Georgia, and Alabama). The main operating company is Canadian Forest Products Ltd., from which the name Canfor is derived.

Built on a reputation of sustainable forest management, customer service, and high quality products, Canfor is one of the world's largest producers of sustainable lumber, pulp, and paper, while at the same time incorporating the production of viable green energy at many of its facilities. The company's history can be traced back to the late 1930's and two entrepreneurs (John Prentice and Poldi Bentley) who formed a furniture and paneling veneer company called Pacific Veneer. Through acquisition, the Grande Prairie division became part of the Canfor umbrella in 1955.

Canfor has a diverse marketing portfolio with products being sold in countries around the world from Canada, the United States, China, and Japan. Canfor prides itself on people, relationships, and the practice of sustainable forest management that will result in future healthy forests.

2.1.2 HISTORY

Canfor's Grande Prairie Division history started in 1953. Canfor's modern sawmill complex is located within the City of Grande Prairie. Logs for the mill are provided under Forest Management Agreement (FMA) #9900037 with the Province of Alberta and two coniferous timber quotas (CTQP190001 and CTQP520003). The original 20-year FMA was signed on May 26, 1964.

A complete timeline of Canfor Grande Prairie's history is outlined in Figure 1.

1953	<ul style="list-style-type: none"> Northern Plywoods Ltd. Constructed a plywood mill on the outskirts of Grande Prairie to utilize balsam poplar
1955	<ul style="list-style-type: none"> Canadian Forest Products Ltd. (Canfor), a Vancouver based and wholly Canadian-owned wood products company, started to assist Northern Plywoods with marketing support and technical assistance, and eventually provided capital for expansion
1961	<ul style="list-style-type: none"> Canfor bought the Grande Prairie Lumber Company and the remainder of the shares of Northern Plywoods and amalgamated the two as North Canadian Forest Industries Limited (NCFI). The new company was an integrated forest products company producing plywood and lumber
1964	<ul style="list-style-type: none"> NCFI acquires timber holdings by signing a Forest Management Agreement encompassing approximately 287,863 hectare located east (Puskwaskau area) and south-east of Grande Prairie (Smoky, Simonette/Waskahigan areas)
1965	<ul style="list-style-type: none"> NCFI closes the bush mills and became the first company in Alberta to centralize sawmill facilities in Grande Prairie First sawmill in Alberta to establish the process of wastewood chipping—the chips were sent to Prince George by rail In the late 1960's, Canfor had the opportunity to pursue pulp development in the Grande Prairie area – this was considered, but because we were already stretched to the limit with the construction of two joint venture pulp mills in B.C., reluctantly declined. This paved the way for Proctor and Gamble and hence Weyerhaeuser
1971	<ul style="list-style-type: none"> The original boundaries of the Canfor Forest Management Area were amended to include the Peace (north of Spirit River) and additional area east of the Waskahigan
1974	<ul style="list-style-type: none"> NCFI acquires Imperial Lumber Company Ltd
1977	<ul style="list-style-type: none"> The E8 Management Unit was added to the Forest Management Agreement Area and was located along the Forestry Trunk Road towards Muskeg Corner
1981	<ul style="list-style-type: none"> NCFI becomes a division of Canadian Forest Products Ltd. of Vancouver, B.C. The name is changed to Canadian Forest Products Ltd., Alberta Operations (Canfor) Canfor purchases Swanson Lumber Ltd. and the Chisholm planer mill holdings from Koppers International
1986	<ul style="list-style-type: none"> The W1C Forest Management Unit (located southeast of the FMA) was added to the FMA area
1989	<ul style="list-style-type: none"> Grande Prairie studmill ceases and a new sawmill is built utilizing narrow kerf and optimizing technology to increase recovery
1991	<ul style="list-style-type: none"> Plywood plant ceases operation and logs are re-directed to the sawmill
1999-2004	<ul style="list-style-type: none"> Grande Prairie Sawmill modernization. The project ultimately resulted in a 15-20% improvement in lumber recovery and 10-15% increase in sawmill production
2009	<ul style="list-style-type: none"> As a result of heavy MPB infestation in the Grande Prairie Area, Canfor committed to the implementation of a Healthy Pine Strategy, in which focus of harvest was the removal of highly susceptible pine to minimize further spread of the MPB
2011	<ul style="list-style-type: none"> Co-gen Plant acquisition to utilize waste fibre from the sawmill to produce electrical power. Electrical power produced at the plant is used in the Canfor sawmill and sold on the provincial power grid. By-product steam from the plant is used to heat Canfor's lumber dry kilns As a means to mitigate the effects of the shift from predominantly spruce profile to pine, the company decided to change the operation's harvesting and log hauling methods from tree length to cut-to-length methodology. This resulted in the complete re-build of the log yard in Grande Prairie and the dismantling of the 26 year old portal crane and track
2012-2013	<ul style="list-style-type: none"> Further upgrades to the sawmill including expansion of the planer facility

Figure 1 Canfor Grande Prairie History

2.1.3 MANUFACTURING FACILITIES

The Grande Prairie division employs 190 full time employees and supports numerous other regional businesses in the production of approximately 297 million board feet of dimensional lumber and 118,131 megawatts (Mwh) of green electrical power per year.

2.1.3.1 Sawmill

The Grande Prairie sawmill complex was built in 1989 with several modernization capital expenditure projects occurring since. Most recent investment projects occurred in 2011 and 2014. Due to the outbreak of mountain pine beetle in the region in 2006 and again in 2009, Canfor's operations shifted focus to pine harvest which resulted in a significant reduction in log size, length, and quality for the Grande Prairie operation. In order to accommodate this shift and mitigate impacts, the company changed the operation's harvesting and log hauling methodology from tree length to a cut to length system. As a result, in 2011 the log yard was completely rebuilt. Canfor also chose to modernize and expand the planer facility during that time.



Figure 2 Canfor Grande Prairie Sawmill and Co-generation Facilities

2.1.3.2 Canfor Green Energy

In June 2005, operations commenced at the Grande Prairie co-generation facility owned by Canadian Gas & Electric (CG&E). Under terms of an agreement between CG&E and Canfor, Canfor was responsible for the co-generation plant fibre supply. Approximately 60% of the required fibre comes from the Canfor Grande Prairie sawmill as residual bark, shavings and sawdust and the remainder has to be acquired from other sources. Due to a shortage of residual waste in the Grande Prairie area, most of the purchased fibre supply for the co-generation plant has been sourced from Canfor's sawmill operations in Fort St. John and Chetwynd, BC. Periodically, residual waste fibre has been purchased from Weyerhaeuser, Norbord, or other local producers, when it is available.

The CG&E plant was later transferred to Trans Alta and ultimately purchased by Canfor in 2011 under the title of Canfor Green Energy. The fibre supply for the plant beyond that produced in the Canfor Grande Prairie milling operation continues to be transported from British Columbia. It should be pointed out that subsequent to the mountain pine beetle infestation in Alberta in 2006, Canfor has annually applied for and been granted authorization from the province under Section 164.1 of the Forest Act to import this material.

The Canfor Green Energy biomass co-generation facility provides renewable heat and electricity to the Canfor Grande Prairie sawmill and sells renewable electricity to the Alberta grid.



2.1.4 CANADIAN STANDARDS ASSOCIATION (CSA) CERTIFICATION

As stated in Canfor's *Environment Policy* (Canfor, 2011a) and *Sustainable Forest Management Commitments* (Canfor, 2012c), Canfor is committed to sustainable management of the forest, while at the same time acknowledges and values the company's contribution to the economic and social viability of the communities in which it operates.

In July 1999, Canfor formally announced its commitment to seek sustainable forest management certification of the Company's forestry operations under the Canadian Standards Association (CSA) Sustainable Forest Management System standard.

The purpose of the CSA standard is to describe the components and performance objectives of a sustainable forest management system. Under the system, the certification applicant must specify a Defined Forest Area (DFA)¹. Canfor designated the FMA area as the DFA.

The CSA system ensures that management values, objectives, indicators and targets are developed for the 6 criterion with 15 elements for sustainable forest management established by the Canadian Council of First Ministers (CSA, 2008). Through a process of public participation, the CSA performance framework attains a local relevance in the form of locally determined Values, Objectives, Indicators and Targets (VOITs).

Canfor has applied improvements to its management systems and performance under its existing International Organization for Standardization 14001 certification and through implementation of the 2012 *Sustainable Forest Management Plan* (Canfor, 2014a) for the Grande Prairie DFA. Canfor Grande Prairie's Sustainable Forest Management Plan (SFMP) was certified to the CSA Z809-08 standards in August 2012, after an extensive review by KPMG, an independent third party audit firm. The primary components of the SFMP (Appendix H) including VOITs are aligned with Annex 4 of Alberta's Forest Management Planning Standards contained in the Forest Management Plan (FMP).

The 2012 *Sustainable Forest Management Plan* (Canfor, 2014a) can be viewed on Canfor's website: <http://www.canfor.com/environmental/certification>

2.2 Overview of the Timber Industry on the FMA Area

Canadian Forest Products Ltd., Grande Prairie Operations (Canfor) has a FMA, and Norbord Inc. and Tolko Industries Ltd. have timber quotas within the FMA area.

Companies operating within the FMA area obtain the timber supply for their various manufacturing facilities from timber obtained within and outside the FMA area. Depending on the company, other sources of timber that may be utilized include salvage, private purchases, crown land timber purchase programs (commercial timber permits), and log purchases from other companies. The primary source of timber for all companies consists of allocations from the Alberta tenure system.

¹ Defined Forest Area (DFA) is "a specified area of forest, including land and water (regardless of ownership or tenure), to which the requirements of this Standard apply" (CSA, 2008). The designated forest area for the SFMP is Canfor's FMA area.



Alberta Environment Sustainable Resource Development (AESRD) is responsible for overall land management and ensuring that the forest industry meets all responsibilities and obligations for management of the forest resource. Timber is allocated to the various users through the tenure system. The tenure system includes 3 types of tenures: the Forest Management Agreement, the Timber Quota, and the Timber Permit.

A FMA agreement is a long-term, negotiated and legislated agreement between the Province of Alberta and a company to establish, grow, and harvest timber on a perpetual, sustained-yield basis in a defined land area. The volume of timber that can be harvested is determined through the annual allowable cut (AAC) calculation. The forest company is required to conduct forest management responsibilities, established by the Government, which can change over time based on changing needs and science.

There are two types of timber quotas in the province: Coniferous Timber Quota (CTQ) and Deciduous Timber Allocation (DTA). There are no CTQ's in the FMA area, but there are three DTAs.

There are two types of timber permit allocations as per the FMA:

- 1) Short-term timber dispositions from within the forest management area to provide timber for local use in construction and maintenance of public works by any local authority, municipality, county, the Crown, and for local residents; and
- 2) Short-term coniferous timber dispositions from within the FMA area to maintain the Community Timber Program (CTP).

2.2.1 FOREST MANAGEMENT AGREEMENT (FMA)

On May 26, 1964, Canadian Forest Products Ltd. (formerly North Canadian Forest Industries Limited) entered into a 20-year Forest Management Agreement with the Province of Alberta. This Agreement was renewed in 1978 and again in 1999. Although the 1999 agreement was in effect until 2019, Canfor chose to apply for early FMA renewal and began the process in 2013. The new FMA (O.C.12/2015) was ratified by the Province in cabinet on January 30, 2015 and is effective May 1, 2015 until April 30, 2035 (GoA, 2015b) (Appendix A).

The FMA agreement grants Canfor the rights to:

- *Establish, grow, and remove timber thereon as provided for in the approved forest management plan;*
- *Carry out silviculture and other programs that are approved by the Minister in accordance with this Agreement; and*
- *Construct, operate, and maintain roads, bridges, camps, timber processing operations, wood concentration yards, and other installations necessary and incidental to the Company's right to establish, grow, harvest, and remove timber from the forest management area (GoA, 2015b).*

As per subparagraph 10(1) of the FMA agreement, a Forest Management Plan (FMP) must be submitted to the Minister by May 1, 2015 (GoA, 2015b). The FMP defines activities in a specific geographic area

and time period, and provides detailed justification and environmental planning to support the AAC for both coniferous and deciduous species from the FMA area.

2.2.2 CANFOR GRANDE PRAIRIE SAWMILL ANNUAL CONIFEROUS LOG REQUIREMENTS AND SOURCES

2.2.2.1 FMA Area Timber (Canfor)

The FMA area is the primary source (approximately 65%) of coniferous timber for the Grande Prairie sawmill. Canfor has the right to harvest coniferous species within the FMA area. The current coniferous annual allowable cut (AAC) is 715, 000m³. Canfor utilizes White Spruce, Black Spruce, Lodgepole Pine and Balsam Fir.

Coniferous Utilization Standard

Utilization standard is the merchantable standard which is used in the calculation of the annual allowable cut. The coniferous utilization standard is 15/12 where:

- *Merchantable stand is a stand that has reached the minimum harvest age and volume as stated in the Resource Timber Supply Analysis (Appendix J);*
- *Merchantable Tree: one that has a minimum diameter of 15 cm (outside bark) at stump height of 30 cm and a merchantable length of 4.88 m to a 12 cm top diameter (inside bark); and*

Harvesting and Hauling Methods

Safety and the environment are important to Canfor. Most of Canfor's harvesting and hauling is done by stump to dump contractors. At any time the Canfor's harvesting supervisors and/or contractors have the authority to stop operations when they believe that operations could be unsafe or may cause an unfavourable impact on the environment.

In 2011, Canfor moved from a tree length to a cut to length system (CTL) that is delivered to the Grande Prairie sawmill to increase log haul safety and sawlog quality primarily due to the challenges of utilizing dead and dying Mountain Pine Beetle infested trees. The CTL system also makes the utilization of smaller piece size logs more efficient and economically feasible.



Figure 3 Log Truck Hauling Cut-to-Length Logs

Approximately seventy percent of the harvest is completed in the winter months. Harvesting in the winter months reduces the amount of permanent roads, has less of an impact on certain ground conditions, and avoids disturbance of migratory birds during sensitive nesting periods. All harvesting is done with highly modernized mechanical equipment. In general harvesting of trees is done in three phases: 1) felling; 2) skidding; and 3) processing.



Figure 4 Feller Buncher

More than ninety-five percent of the logs delivered to the sawmill from the FMA area are hauled on Canfor's main private road south of Grande Prairie, and at times using secondary highway 743 and/or other resource user's private road connectors. Alberta Transportation must approve all public log haul routes. Canfor consults with, and obtains approval from, the respective County and Municipal councils prior to applying to Alberta Transportation.

Due to the long hauling distance and short hauling season, Canfor is now utilizing remote satellite yards. This allows a longer season for log haul and helps balance the sawlog profile for the Grande Prairie sawmill, while also providing a longer season for the limited trucking labour force.

2.2.2.2 Quota Timber (Canfor)

Canfor has two Coniferous Timber Quota's (CTQ) within Daishowa-Marubeni International Ltd.'s (DMI) FMA # 0900045 that also supply timber to Canfor's Grande Prairie sawmill. CTQP190001 has an AAC of 430, 454m³ and CTQP520003 has an AAC of 3,195m³.

2.2.2.3 Purchase Timber

Over time, the Canfor Grande Prairie sawmill has gradually experienced improved performance in terms of productivity, resulting in a corresponding increase in log consumption. This has impacted the proportion of log volume required by the mill that Canfor has under tenure, and by necessity, the amount of log volume that must be purchased. For example, from 1999 to 2001 the FMA AAC represented nearly 100% of the Grande Prairie sawmill volume requirements. However, significant capital investments in the sawmill in 2000 combined with a 12% reduction in AAC in 2001 resulted in a deficit timber supply position that has persisted through much of the reporting period.

Whereas timber supply deficits in some parts of Alberta are easily addressed through log purchases, the situation in Grande Prairie is complicated due to the fact that nearly all crown timber is allocated to existing tenure holders. Furthermore, there are relatively low volumes of mature coniferous timber available on private land in the region. Therefore, Canfor's strategy regarding acquisition of timber has been focused primarily on volume supply agreements with other tenure holders, many of which involve the trading of chips or pulp logs for saw logs. For example, Canfor has existing volume supply agreements with Weyerhaeuser and Daishowa-Marubeni International that involve the trading of chips and/or pulp logs for saw logs and had similar agreements with Alberta Newsprint Company in the past.



Canfor has also purchased logs from tenure holders such as Alberta Plywood, S11 Timber Company, Vanderwell Contractors and participants in Alberta's Community Timber Program.

Peak purchases occurred from 2002 to 2004 when Canfor's tenured timber supply was in a serious deficit position. The deficit was alleviated partially by the closure of the Hines Creek mill in June 2005, thereby reducing the division's dependency on purchase wood. Spikes in purchases following that have been a reflection of the availability of wood from other sources. For example, the company purchased substantial volumes of pine from Grande Prairie County and through the province's timber salvage programs following the mountain pine beetle infestations in 2006 and 2009. Similarly, Canfor has harvested infested stands from Weyerhaeuser's FMA area on several occasions since 2007 as a means of controlling future outbreaks in the Smoky Region.

2.2.2.4 Salvage Timber

Salvage timber is timber that is harvested in the clearing of land for other industrial uses. Canfor is notified when other industries will be constructing and clearing land for dispositions on the FMA area and if salvage timber will be produced from the clearing of the land for those dispositions. Canfor's objective is to utilize as much salvage timber from the FMA area as possible. At times, this may be difficult because the salvage timber is either inaccessible or un-merchantable. On average Canfor purchases 2.5% of its AAC volume through timber salvage.

2.2.2.5 Residual Fibre Utilization

Canfor has invested in thermal energy systems to replace fossil fuels such as natural gas with biomass, which is carbon neutral and provides a consistent, reliable and renewable source of energy (Canfor, 2015c). By using bark and planer shaving wood residuals to generate clean energy, Canfor has reduced its greenhouse gas emissions and improved air quality, while ensuring that there is very little wood wasted in the lumber manufacturing process. In 2014, Canfor Grande Prairie sawmill provided 49,750 ODT (about 84,723 green tonne) of hog residual to Canfor's Green Energy facility in Grande Prairie, which generates heat and electricity for the Canfor Grande Prairie sawmill as well as renewable electricity for the Alberta grid.

As described in Section 2.2.2.3, Canfor sometimes leverages residual conifer chips to procure additional log supply. However, the vast majority of chips produced at the Canfor Grande Prairie sawmill have historically been sold to Weyerhaeuser Grande Prairie's pulp mill. In 2014, Canfor provided 3900m³ of pulp wood and 71,165 ODT (about 109, 500 green tonne) of chips to Weyerhaeuser Grande Prairie's pulp mill.

2.2.3 DECIDUOUS TIMBER ALLOCATIONS

Supplemental to rights granted to Canfor with respect to coniferous timber, embedded within the FMA area are Deciduous Timber Allocations (DTA) for Norbord Inc. (DTAG150003) and Tolko Forest Industries Ltd (DTAG150001 & DTAG150002)(Table 1).

Table 1 Current Deciduous Allocations

Company	DTA	Current Allocation Volume m ³ /yr
Norbord	G150003	170,000
Tolko	G150001	114,712
	G150002	167,817
Total		452,529

Deciduous Utilization Standard

Utilization standard is the merchantable standard which is used in the calculation of the annual allowable cut. The deciduous utilization standard is 15/10 where:

- *Merchantable stand is a stand that has reached the minimum harvest age as stated in the Resource Timber Supply Analysis “Appendix J”;*
- *Merchantable Tree: one that has a minimum diameter of 15 cm (Outside bark) at stump height of 30 cm and a merchantable length of 4.88 m or greater to a 10 cm top diameter (inside bark), or where the stem is unusable or there is no central stem due to heavy branching; and*

2.2.3.1 Norbord Inc.

At the time the Canfor Forest Management Agreement (FMA) became effective, Ainsworth Engineered Canada Ltd. held a DTA within previous Forest Management Unit (FMU) G5C that provided Ainsworth with rights to harvest 170,000m³ per year of deciduous timber (i.e. trembling aspen and balsam poplar). Following the amalgamation of several FMU's in 2005 (FMU G15), Ainsworth was issued DTAG150003 that authorized harvest of deciduous timber within the FMA area for its OSB facility south of Grande Prairie.

In early 2015, Ainsworth Engineered Canada Ltd. merged with Norbord Inc. under the Norbord name. All future work by Ainsworth representatives will therefore be conducted under the Norbord title.

2.2.3.2 Tolko Industries Ltd.

Tolko currently holds two DTA certificates on the FMA area. Total combined deciduous AAC for the two certificates is 282,529m³ per year. Tolko owns an OSB facility in High Prairie, but closed the mill indefinitely in February, 2008 due to poor market conditions.

2.2.4 COMMUNITY TIMBER PROGRAM

As stated in the Forest Management Agreement with the Province of Alberta, 10, 000m³ of coniferous timber must be made available annually for the Community Timber Program (CTP). If this volume goes unutilized, then Canfor will be able to utilize it for its operations. There has been zero use of the volume made available for the Community Timber Program from the 2009 timber year to the 2013 timber year.



3 The Defined Forest Area

The Canfor FMA area is very diverse; its location and resources make it valuable for multiple industries, recreationalists, aboriginal groups, and other stakeholders. The following sections describe the current state of the FMA area in regards to its physical characteristics, values, and land-uses.

3.1 Landscape Assessment

3.1.1 ADMINISTRATIVE BOUNDARIES

3.1.1.1 *Forest Management Agreement Area and Location*

The Forest Management Agreement (FMA) located in North/West Central Alberta, is applicable to three distinct operating parcels totaling 644,695ha, located within Forest Management Unit (FMU) G15 (Figure 5). The three parcels include: Peace (24,101 ha), Puskwaskau (69,674 ha) and Main (550,920 ha) The Peace parcel is North/West of the town of Spirit River; the Puskwaskau parcel is West of the town of Valleyview; and the Main parcel is South East of the city of Grande Prairie.

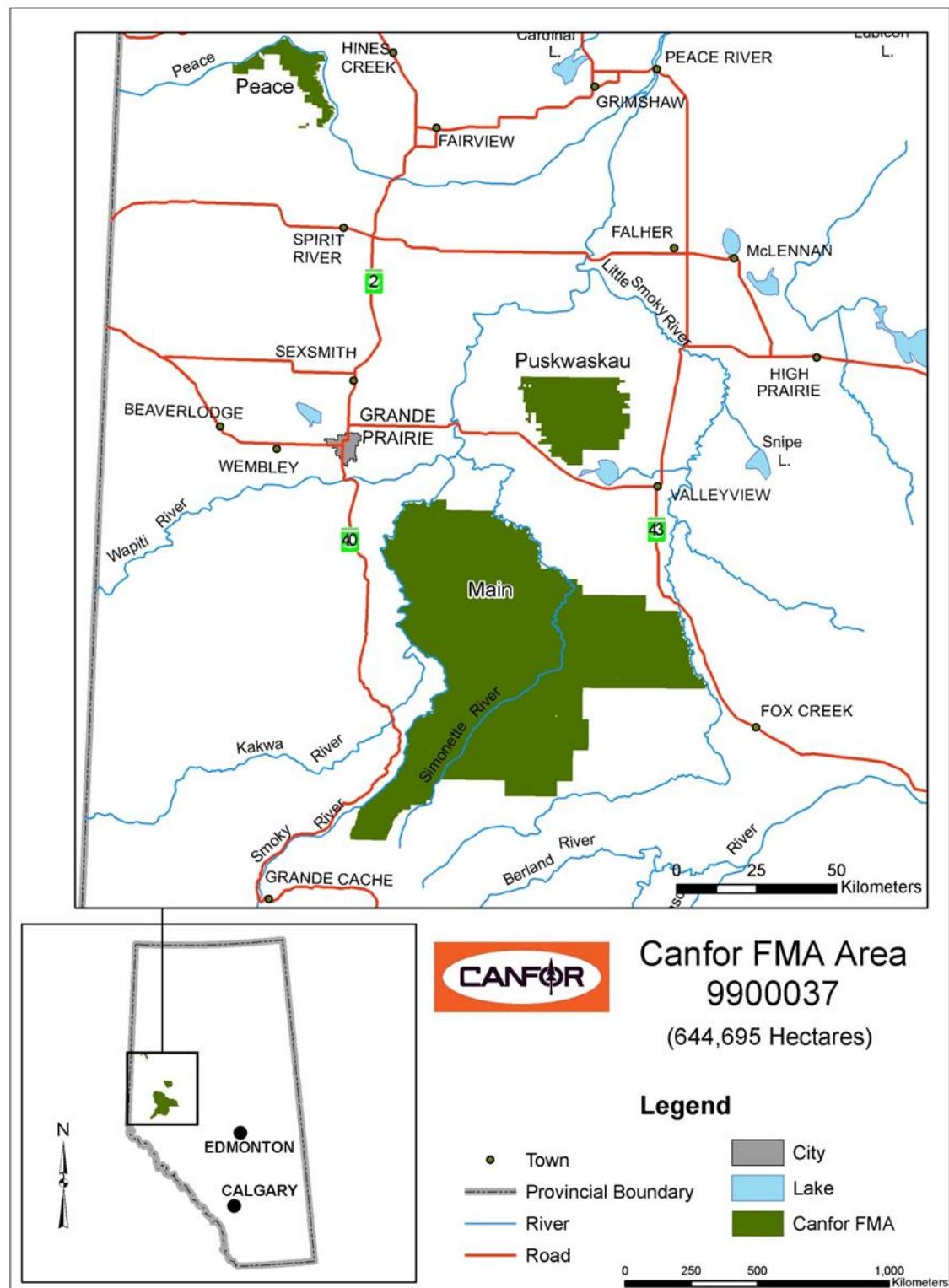


Figure 5 Canfor FMA Area

3.1.1.2 Forest Management Units, Sustained Yield Units, Compartments/Sub-units

The FMA area is divided into twelve Timber Supply Units and further subdivided into sixty-two Timber Supply Subunits (Figure 6). These are not used as sustained yield units; however, they are used for the purposes of developing forest harvest plans and SHS validation.

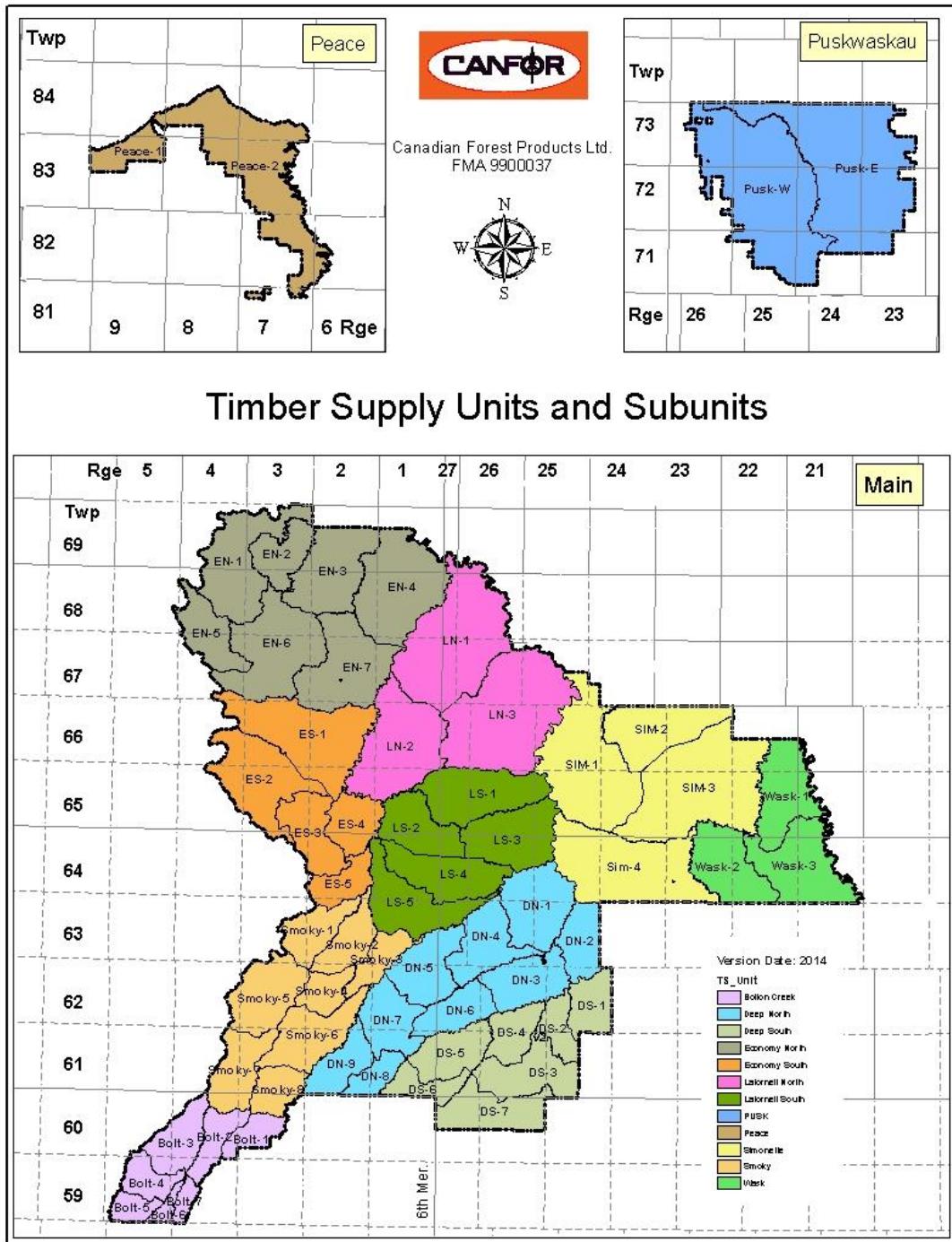


Figure 6 Timber Supply Units and Subunits

3.1.1.3 Municipal Districts/Counties

The FMA area is located within two Municipal Districts (M.D.)/Counties. The Peace parcel is located in the Saddle Hills County and the Puskwaskau and Main parcels are located in MD of Greenview (Figure 7).

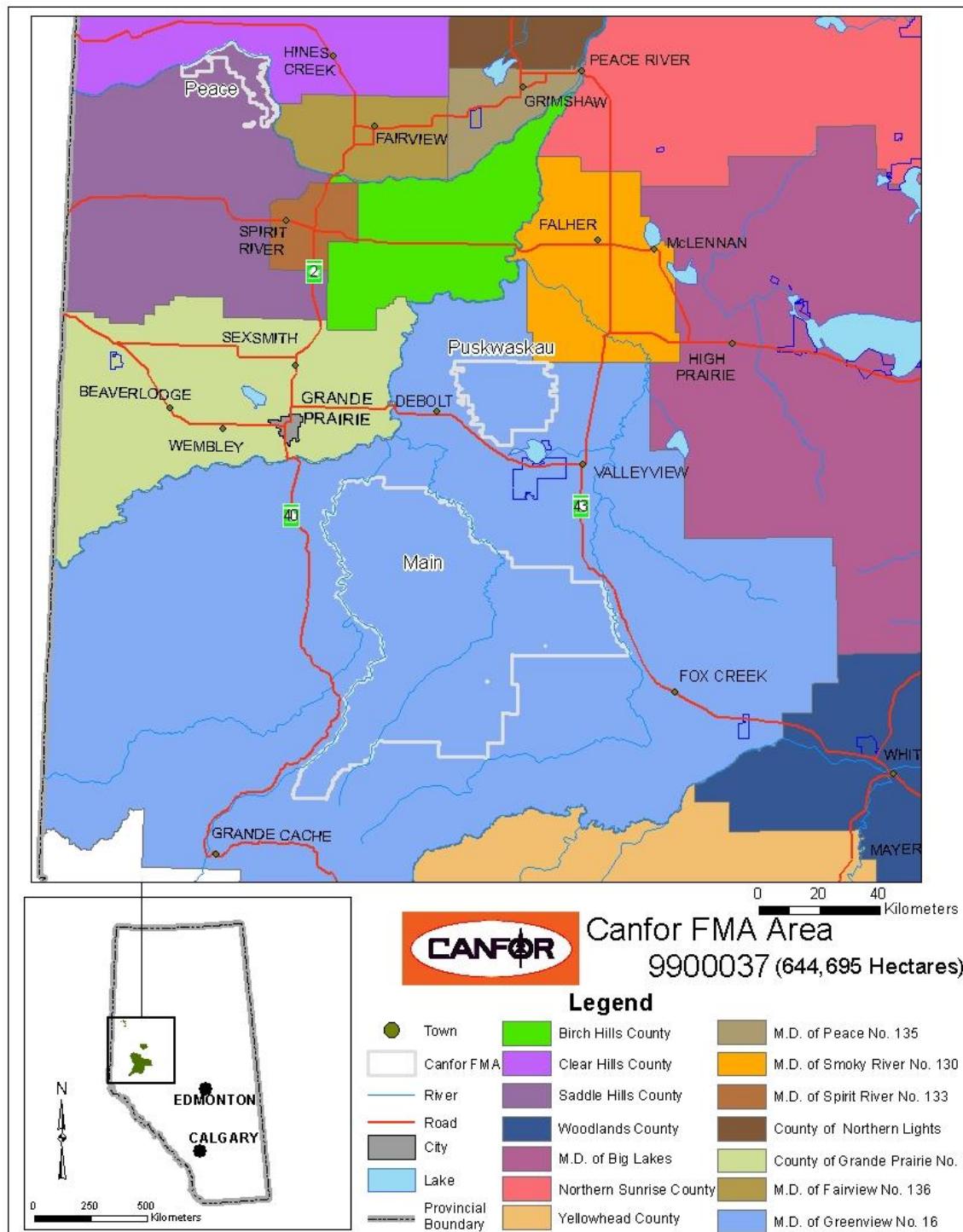


Figure 7 Municipal Districts and Counties

3.1.1.4 Federal Government Lands

There are no Federal Government lands inside or bordering Canfor's FMA area.

3.1.1.5 Aboriginal Communities

The ethnography section of the Historical Resources Overview Assessment (Altamira Consulting Ltd., 1998) provides a discussion of the Aboriginal people who inhabited the area surrounding Canfor's FMA area from proto-historic² to modern times.

The Sturgeon Lake Cree Nation is one Aboriginal group living within the immediate vicinity of the FMA area. Members of the Sturgeon Lake Cree Nation live at the Sturgeon Lake Reserve No. 154 located near Valleyview, Alberta. The Sturgeon Lake Cree Nation is a member of the Western Cree Tribal Council and a party to Treaty 8 (Wikipedia, 2014). They also have two smaller reserves; Reserve 154A and Reserve 154B, located at Goose Lake (69-24-W5M), which provides members with an area for hay production. Today, members are involved in forestry, agriculture and other jobs. Many members of the Sturgeon Lake Cree Nation are still active in their traditional use area which overlaps Canfor's FMA area. Trapping remains an important economic activity for some members, as well as hunting, fishing, berry picking, and collecting medicinal plants.

The Horse Lake First Nation Reserve near Hythe is also located in the general vicinity of the FMA area. It is party to Treaty 8, and is a member of the Western Cree Tribal Council. The Horse Lake First Nation has two reserves, Clear Hills 152C and Horse Lakes 152B under which a portion of their traditional use area falls within Canfor's FMA area. Today, members still utilize their traditional use area for hunting, trapping, medicinal plant, and berry picking.

The Aseniwuche Winewak Nation of Canada (AWN) was formalized in September 1994 by joining the 6 Aboriginal settlements surrounding the town of Grande Cache, Alberta. Aseniwuche Winewak is Cree for Rocky Mountain People. The members of AWN are non-status Indians descended from Cree, Iroquois, Beaver, Sekani, Assiniboine, Ojibwa, and Shuswap who lived in the area (AWN, 2015). Today, members of AWN are actively working with industry and government to educate and provide input on resource development and species habitat management based on their traditional knowledge. AWN members actively use Canfor's FMA area for hunting, fishing, medicinal plants and berry picking. Their representative participates in the development process for the DFMP and SFMP by providing input as an active member of the Forest Management Advisory Committee (Section 5.1.2.1.1).

Sucker Creek First Nation is a Cree First Nation community that was recently added to Canfor's list of First Nations to consult due to recent traditional use area boundary changes. The Sucker Creek First Nation is located east of High Prairie along Lesser Slave Lake in the hamlet of Enilda, Alberta.

² The Proto-historic Period refers to that period of time within a region that occurs immediately preceding the first written record. This is the period of time that immediately precedes the arrival of the first white explorers. It is a period of time when the first European goods and items are traded into Aboriginal culture before the actual arrival of the first white European.



The Metis are Aboriginal people who have played a major role in opening up the North American continent. As Canada grew, the Metis contributed as nation builders, educators, farmers, professionals, entrepreneurs and industrialists. They continue to play a significant role in the evolving partnerships between Aboriginal and non-Aboriginal people in Canada. The Metis Nation of Alberta Association (MNA) consists of a provincially elected executive and an elected executive for each of 6 Zones within the province. In the Grande Prairie area, Zone 6 Metis Nation represents 3 locals:

1. Grande Prairie Local 1990;
2. Red Willow Local 1929; and
3. Aspen Grove Local.

Zone 6 Metis Nation is an active member of the Forest Management Advisory Committee (refer to Section 5.1.2.1.1).

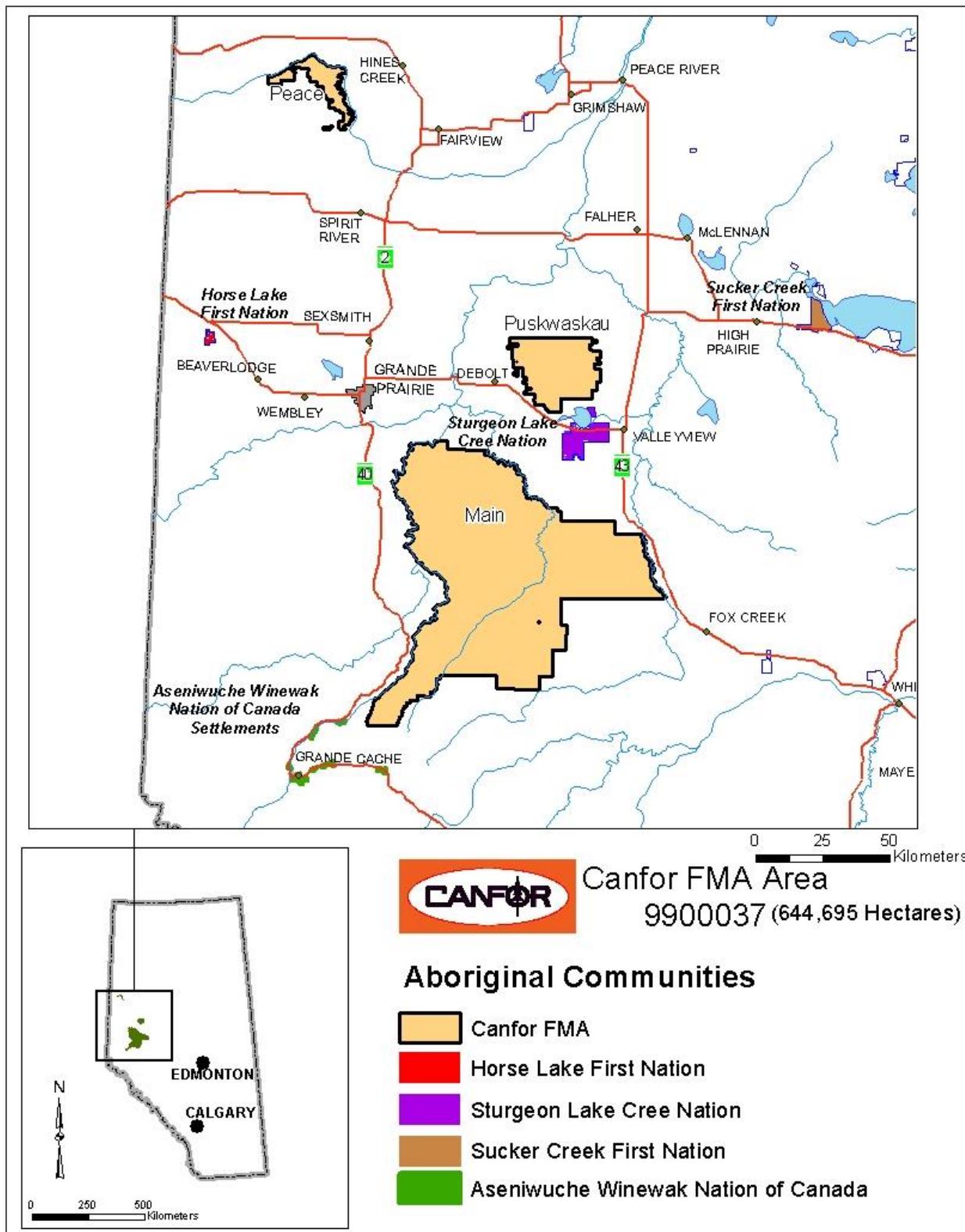


Figure 8 Aboriginal Communities

3.1.1.6 Protected Areas and Parks

There are five protected areas and parks and one special area (Figure 11) located within the vicinity or internal to the FMA area. These are Dunvegan West Wildland Provincial Park, Silver Valley Ecological Area, Young's Point Provincial Park, Sturgeon Lake Recreational Area, Williamson Provincial Park and Parabolic Sand Dunes Special Area (Figure 9).

Canfor supported the removal of portions of the FMA area for the Silver Valley Ecological Reserve, expansion of Young's Point Provincial Park, and the Dunvegan West Wildland Provincial Park (Figure 11).

The Silver Valley Ecological Reserve is 1,805ha and is restricted to foot traffic only and no industrial development. The area consists of the valley slopes of the Peace River; 70% of the area consists of maturing aspen/shrub forest. The area also has six plant species that are beyond their normal range (drooping wood reed, turned sedge, striped coralroot, low mike weed, clustered broom-rape and alpine aster (AESRD, 2014a).

Dunvegan West Wildland Provincial Park (Figure 10) was nominated by Canfor as part of Alberta's Special Places 2000 program. This area was chosen and expanded to 51,810ha in size. *"The park includes a unique mixture of grassland, aspen forest and steep sided creek valleys. Many of the creeks have hoodoos and fossil beds"* (AESRD, 2014a). Random backcountry camping is allowed and ATVs are allowed only on already open existing trails.

The Parabolic Sand Dunes on Canfor's FMA area was nominated by Canfor for the Special Places 2000 program as another unique area, however it was not selected. Despite this, Canfor has elected to not harvest within the 6,125ha of this area because of its uniqueness. The area was formed from westerly winds moving sand that is presently inactive. The dunes are treed with pine and black spruce surrounded by very wet muskeg vegetation types.

Young's Point and Williamson Provincial Parks are very popular spots for camping, recreation, and fishing.



Figure 9 Aerial Photograph of Parabolic Sand Dunes Special Area

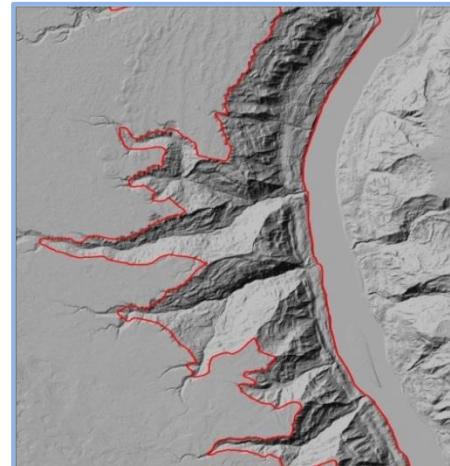
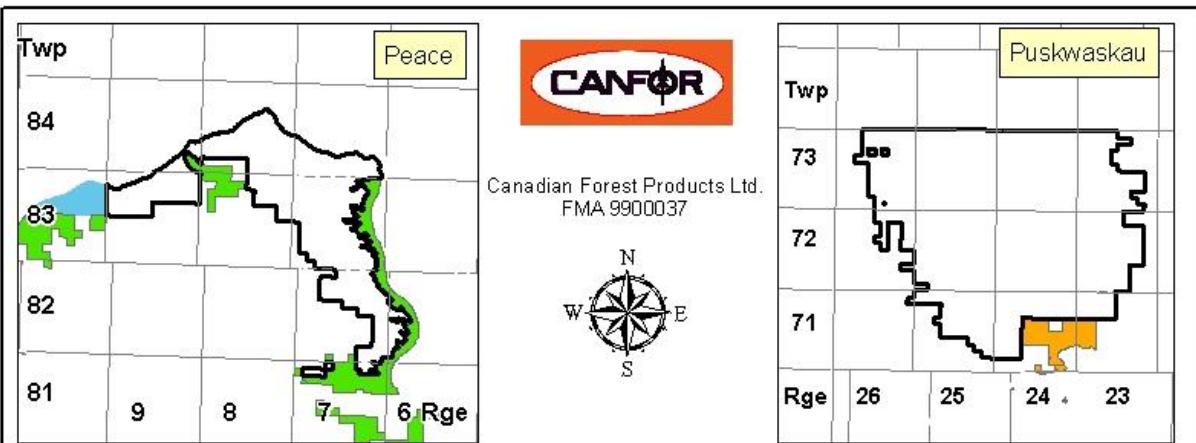


Figure 10 Bare Earth Image of Dunvegan Wildland Park



Protected Area and Areas of Special Biological Significance

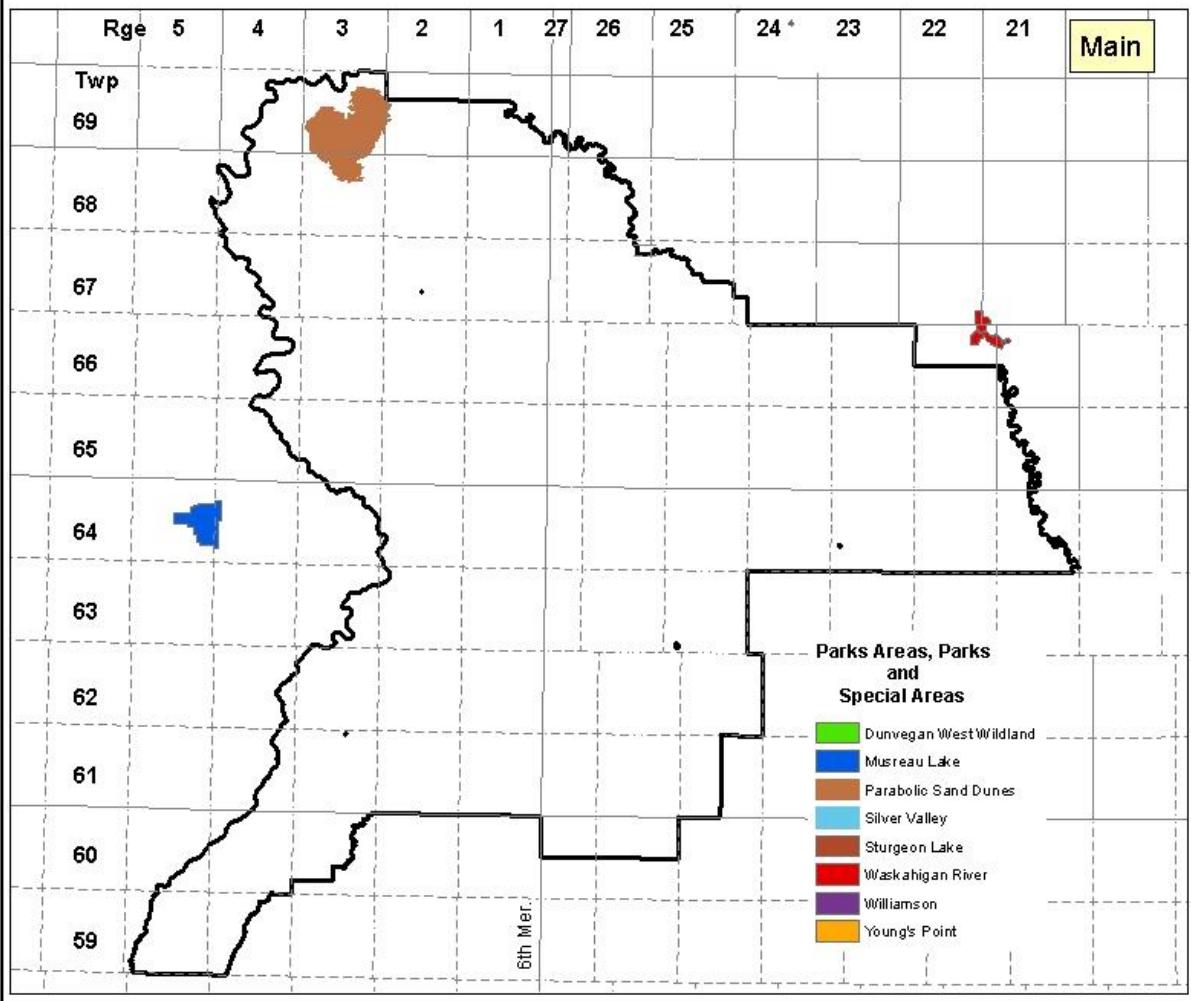


Figure 11 Protected Area and Areas of Special Biological Significance

3.1.1.7 Wildfire Management Areas

The FMA area is within two Wildfire Management areas. The majority of the FMA area is within the Grande Prairie Wildfire Management area and the southwest portion is within the Edson Wildfire Management Area (Figure 12).

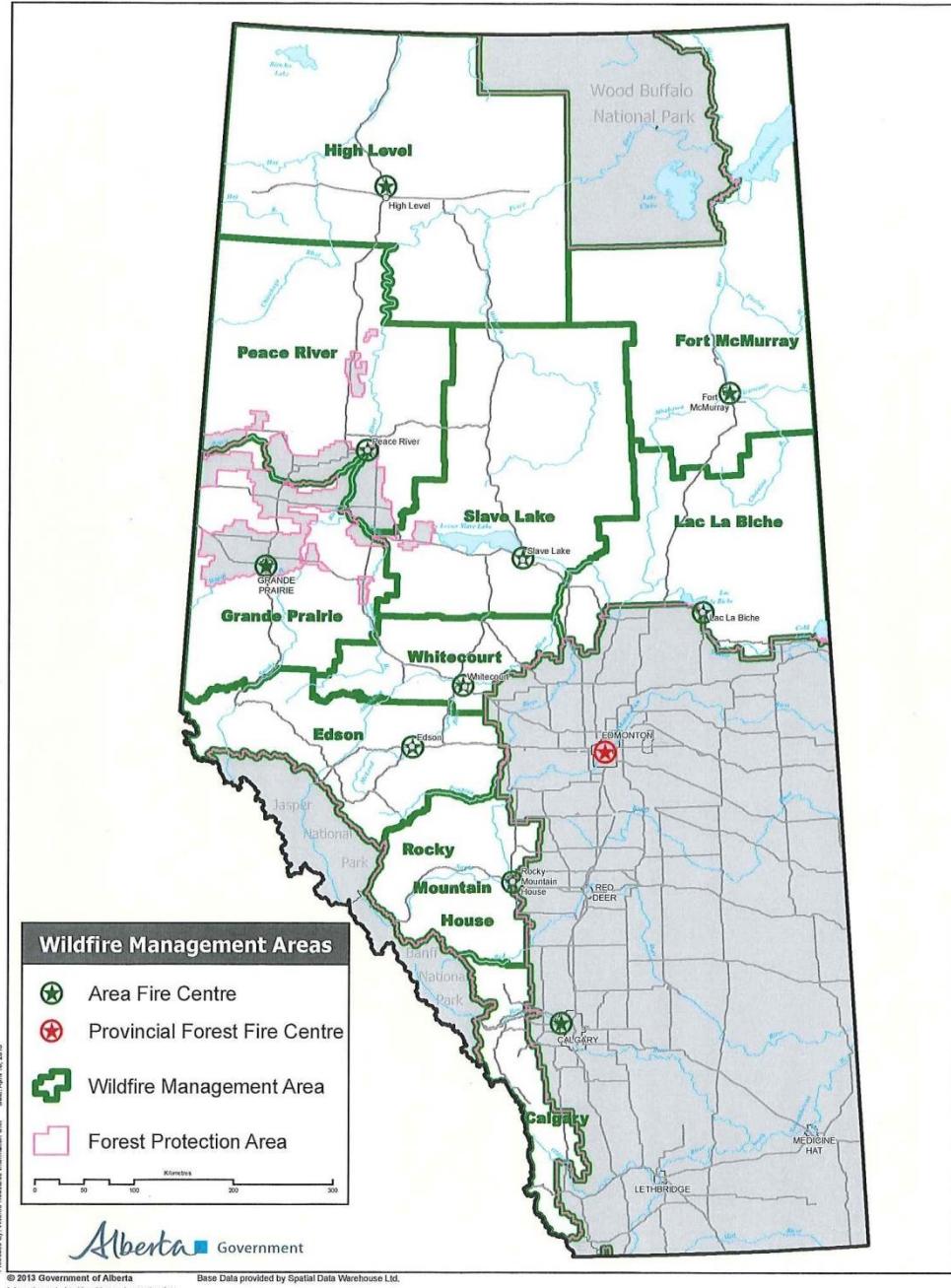


Figure 12 Alberta Wildfire Management Areas (AESRD, 2013)

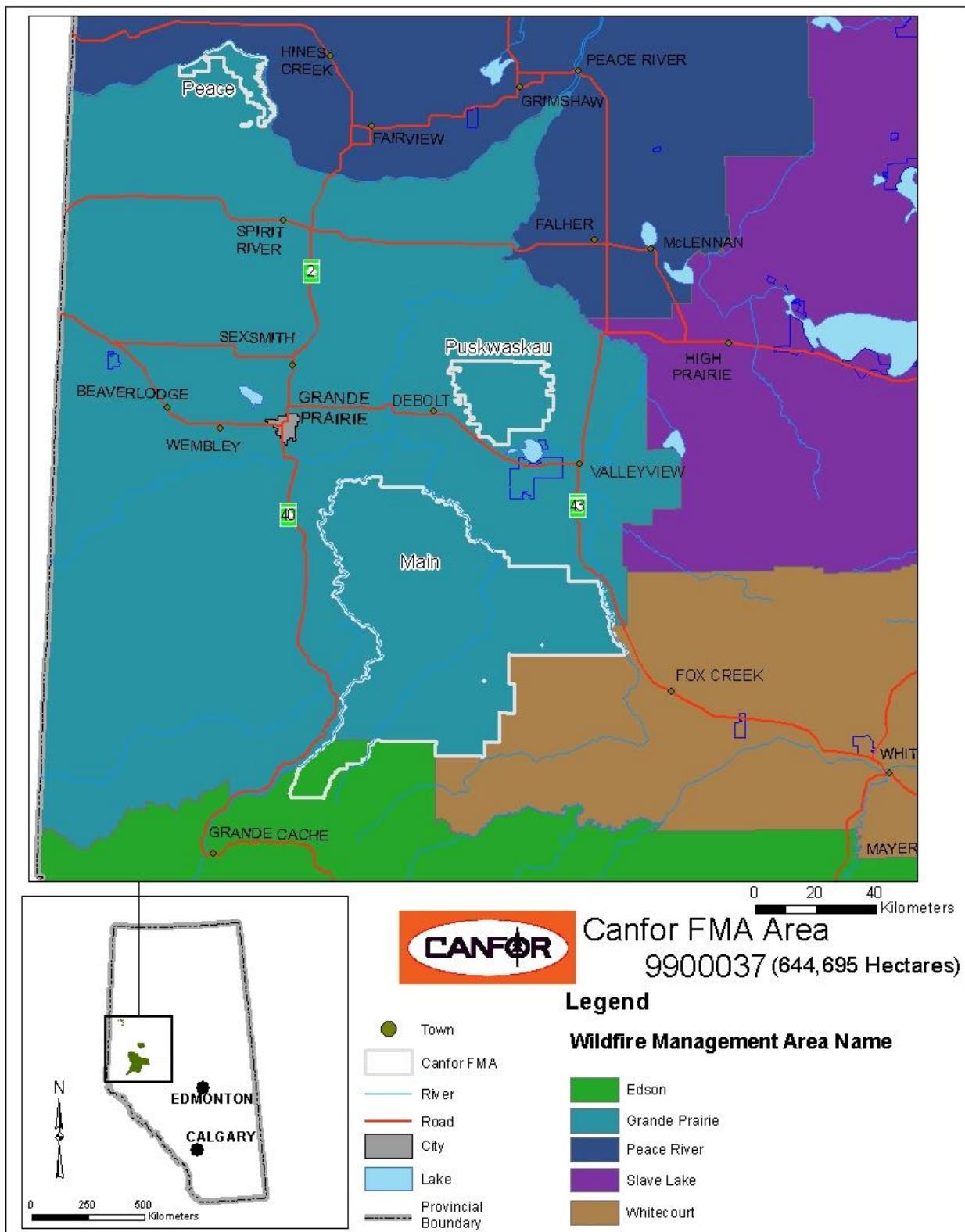


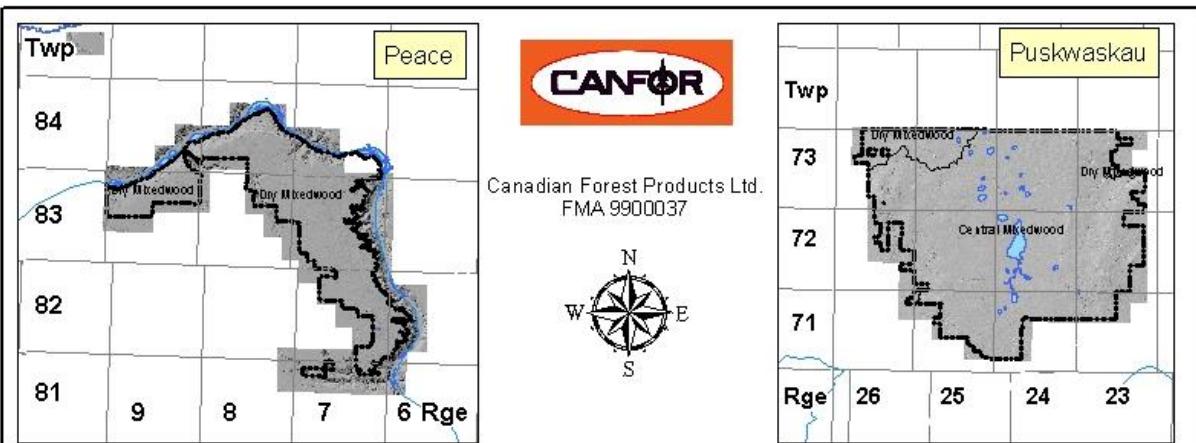
Figure 13 Canfor FMA Wildfire Management Areas

3.1.2 PHYSICAL CONDITIONS

3.1.2.1 Topography

Topography varies throughout the FMA area from flat, gentle rolling, and steep terrain along main river banks and the south/west of the FMA area. “The Foothills Natural Region is highly variable, ranging from sharp, bedrock-controlled ridges near the mountains to rolling and undulating terrain in the north and east. The Boreal Forest Natural Region has level to gently undulating, fine textured lacustrine and till plains are the dominant landform” (Downing & Pettapiece, 2006).

Elevations range from 360m (1,180ft) to 715m (2,350ft) in the Peace parcel, 640m (2,100ft) to 915m (3,000ft) in the Puskwaskau parcel and 505m (1,660ft) north/west, 805m (2,640ft) east and 1,515m (4,970ft) south/west of the Main parcel (Figure 14).



Topography

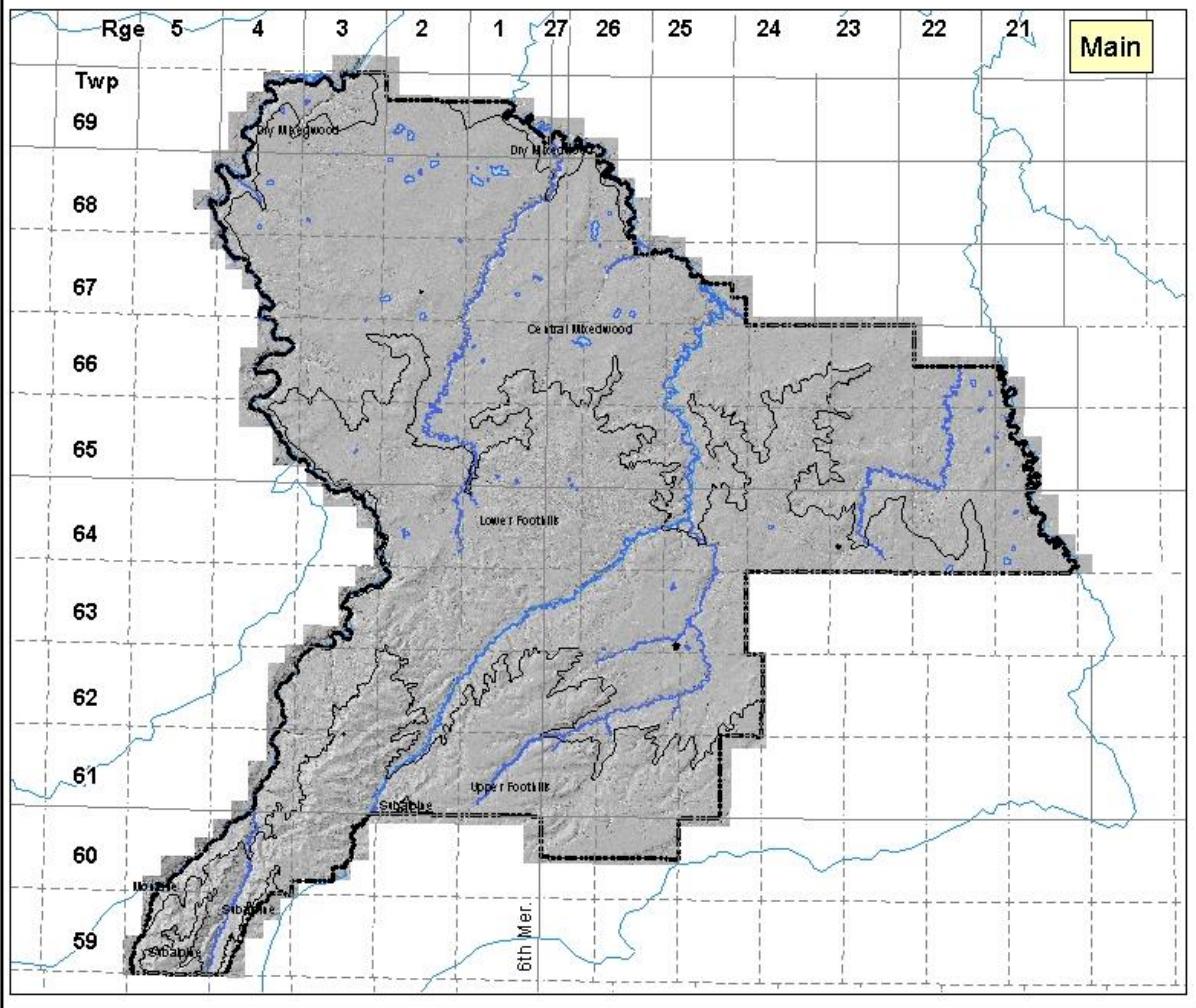


Figure 14 FMA Area Topography

3.1.2.2 Natural Regions

A Natural Region is an area characterized by a distinctive regional climate as expressed by vegetation. It is defined by broad interpretations of regional landscapes, elevation, relief, bedrock geology and major surficial deposits. Thus, Natural Regions provide the “big-picture” of landscapes in the province. In total, there are 6 Natural Regions in the province of which 3 are found within the FMA area, including the Boreal Forest, Foothills, and Rocky Mountain Natural Regions (Figure 15).

The Boreal forest is the largest Natural Region in Alberta and consists of lowland plains, significant wetlands such as bogs, forest swamps, and marshes. The forested area is made up of coniferous and deciduous trees (Royal Alberta Museum, 2006).

The Foothills Natural Region is the transition area between the Rocky Mountains and other Natural Regions and consists of extensive hills and valleys. The Foothills Natural Region consists of a variety of coniferous and deciduous trees, and smaller areas of wetlands such as bogs, fens, and swamps.

The Rocky Mountain Natural Region is very rugged and mountainous with elevations ranging from 1000m to 3700m. Many of Alberta’s largest rivers originate from the Rocky Mountain Natural Region (Downing & Pettapiece, 2006).

Table 2 indicates the area for each Natural Region found within Alberta and the percentage of FMA area occupied by each Natural Region.

Table 2 FMA Area by Natural Region

Natural Region (NR)	Province Area (ha) by NR	FMA Area (ha) by NR	FMA % Area of Province by NR	% Area of FMA by NR
Boreal Forest	38,152,738	351,219	0.9%	54.5%
Foothills	6,647,443	289,064	4.3%	44.8%
Rocky Mountain	4,909,477	4,412	0.1%	0.7%
Total	49,709,658	644,695	1.3%	100%

3.1.2.3 Natural Subregions

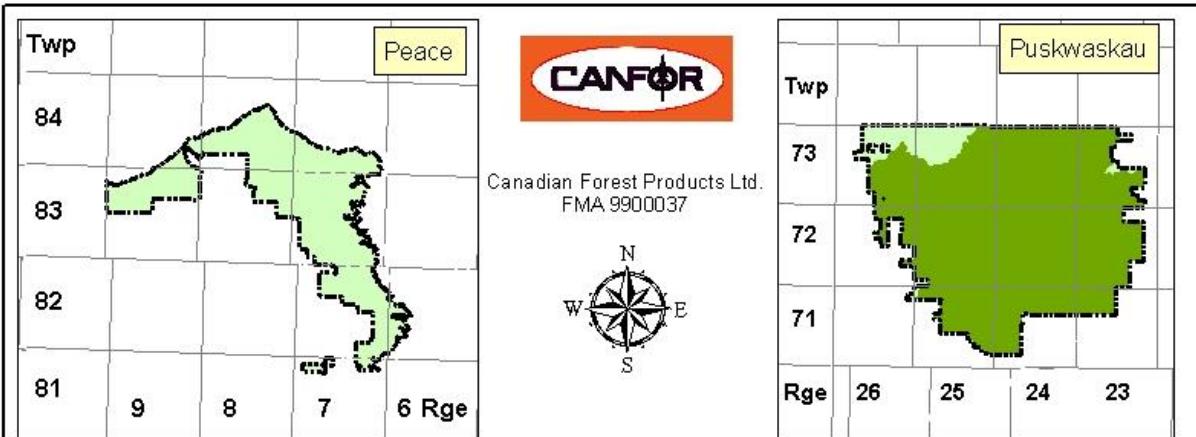
A Natural Subregion is a division of the Natural Region based on differences in regional climate, landform, bedrock geology and soils (Figure 15). Even though the Natural Subregion is generally mapped at the same scale as the Natural Region, the Natural Subregion is more refined through variations in elevation and vegetation. Natural Subregions contain “reference” vegetation types that are characterized by climate and environment (moisture and nutrients).

Table 3 indicates the area for each Natural Subregion found within Alberta and the percentage of FMA area occupied by each Natural Subregion.



Table 3 FMA Area by Natural Subregion

Natural Subregion (NSR)	Province Area (ha) by NSR	FMA Area (ha) by NSR	FMA % Area of Province by NSR	% Area of FMA by NSR
Central Mixedwood	16,811,821	306,689	1.8%	47.6%
Dry Mixedwood	8,540,558	44,530	0.5%	6.9%
Lower Foothills	4,492,905	199,727	4.4%	31.0%
Upper Foothills	2,154,538	89,337	4.1%	13.9%
Subalpine	2,522,650	4,412	0.2%	0.7%
Total	38,054,349	644,695	1.7%	100%



Natural Regions & Subregions

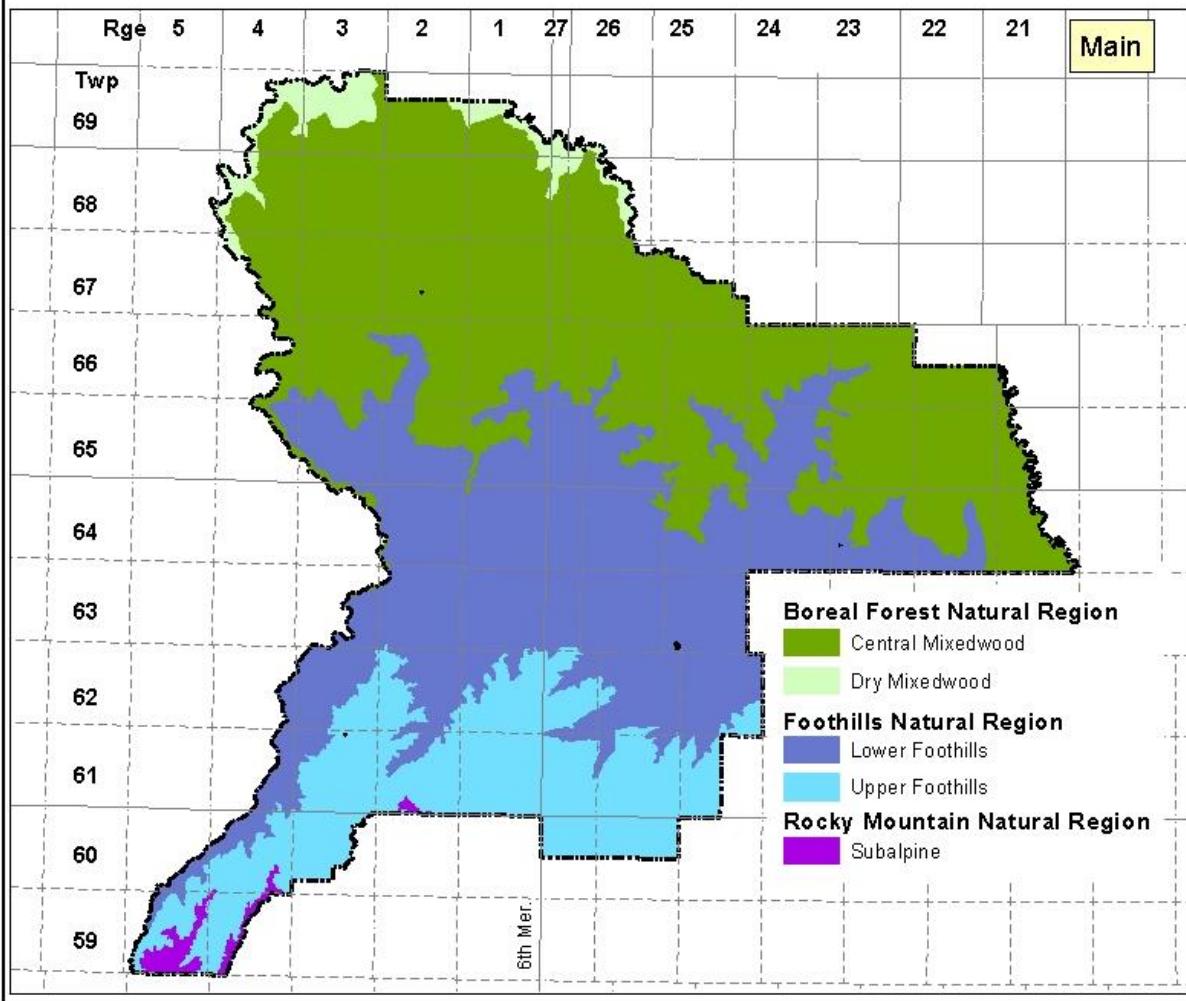


Figure 15 Canfor FMA Area Natural Regions and Subregions

3.1.2.4 Soils and Landforms

The Foothills Natural Region typically consists of rolling foothills and dissected plateaus with large fluvial deposits. Brunisolic Gray Luvisols, Orthic Gray Luvisols, Mesisols, and Gleysols in wetlands are typical to the region (Downing & Pettapiece, 2006).

The Boreal Natural Region (specifically the Dry Mixedwood and Central Mixedwood Natural Subregions) typically consist of undulating plains and hummocky uplands comprised of till, lacustrine and fluvial materials. Soils common to the Boreal Region include Orthic Gray Luvisols, Brunisols on sands, Mesisols, and Gleysols in the wetlands (Downing & Pettapiece, 2006).

The small piece of Canfor's FMA area situated in the Rocky Mountain Natural Region is more likely to include till and residual materials over rolling and inclined bedrock and soils typical to the region are Brunisolic (Downing & Pettapiece, 2006).

3.1.2.5 Watersheds

Alberta has eight major river basins or major river systems; the Peace/Slave, Athabasca, Hay, Buffalo, North Saskatchewan, South Saskatchewan, Beaver and Milk river basins (Figure 17) which flow into the Arctic Ocean.

There are nine main watersheds within Canfor's FMA area (Figure 18). The Peace River provides the main drainage for all 3 areas (Peace, Puskwaskau and the Main parcels). The Peace River begins in the mountains of British Columbia, and flows to Alberta and is influenced by the W.A.C. Bennett Dam, located on the Peace River in British Columbia. The river flows northeast across the province, through the town of Peace River and empties into the Slave River on its way to the Arctic Ocean. The Peace parcel drains directly into the Peace River.

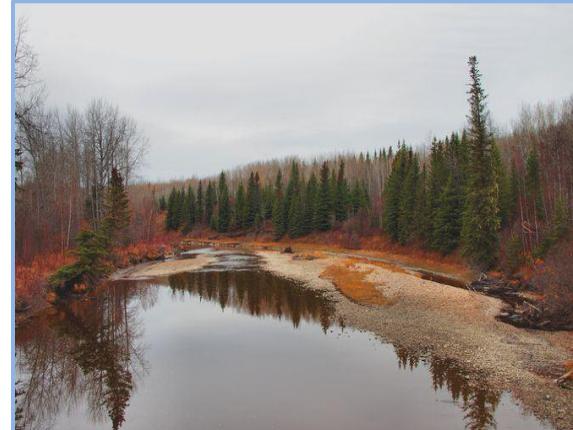


Figure 16 Waskahigan River

Photo Source:

<http://www.theweathernetwork.com/photos/view/outdoor-activities/waskahigan-river/13289936>

The Smoky River provides the primary drainage for the Puskwaskau and Main parcels of the FMA area which empty into the Peace River.

The Simonette River is a tributary of the Smoky River. With its main tributaries, the Latornell River, Economy, and Deep Valley creek, it provides drainage for the central regions of Main parcel of the FMA area.

The eastern portions of Main parcel are drained by the Little Smoky River and its tributary, the Waskahigan River.

The Puskwaskau parcel is drained by the Little Smoky and Puskwaskau Rivers.

The FMA area was further delineated into 89 individual watersheds by AESRD using LiDAR technology³ (Figure 19). These watersheds are used for determining fish risk based on the amount of open permanent and temporary roads and to measure water quality based on the level of disturbance (equivalent clear-cut area) at a given point in time.

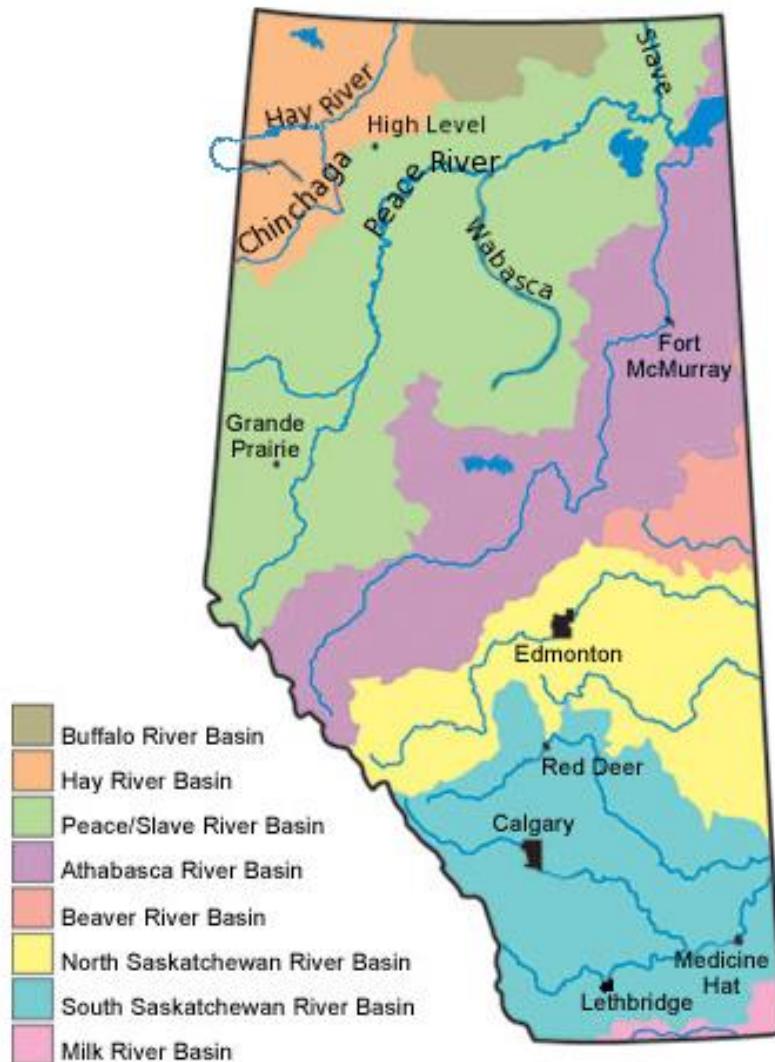


Figure 17 Alberta River Basins (Paddle Alberta, 2015)

³ LiDAR technology “is a remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light. Although thought by some to be an acronym of Light Detection And Ranging, the term LiDAR was actually created as a portmanteau of “light” and “radar” (Wikipedia, 2015).

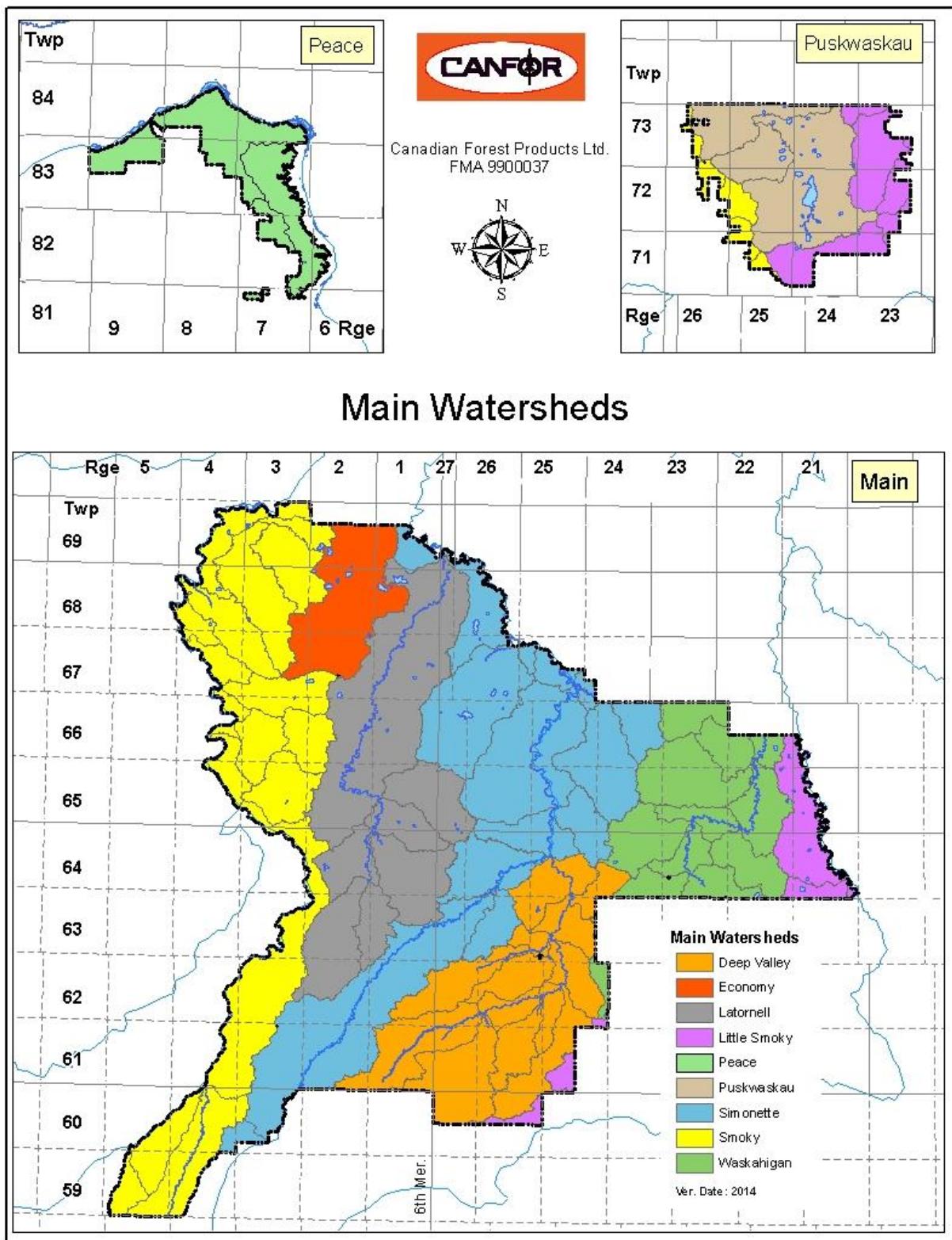
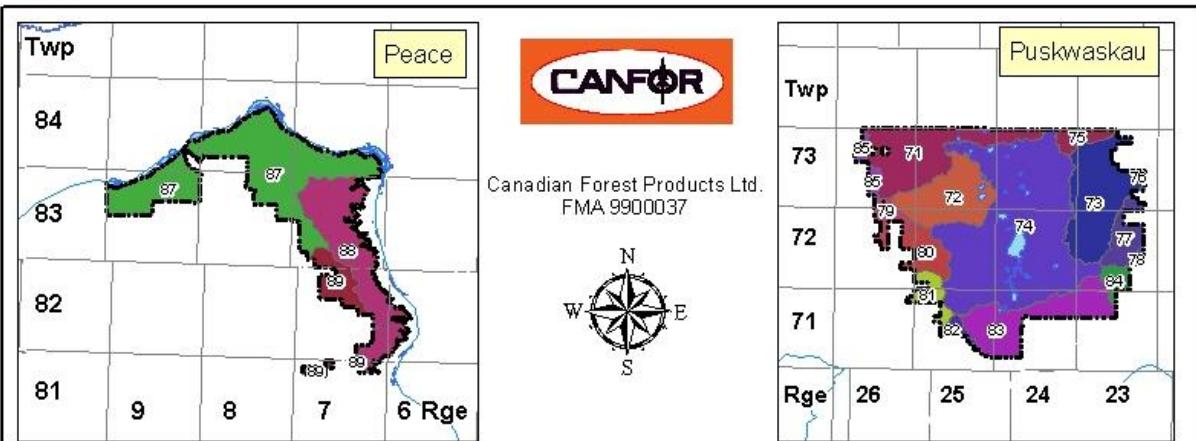


Figure 18 Main Watersheds



Watershed

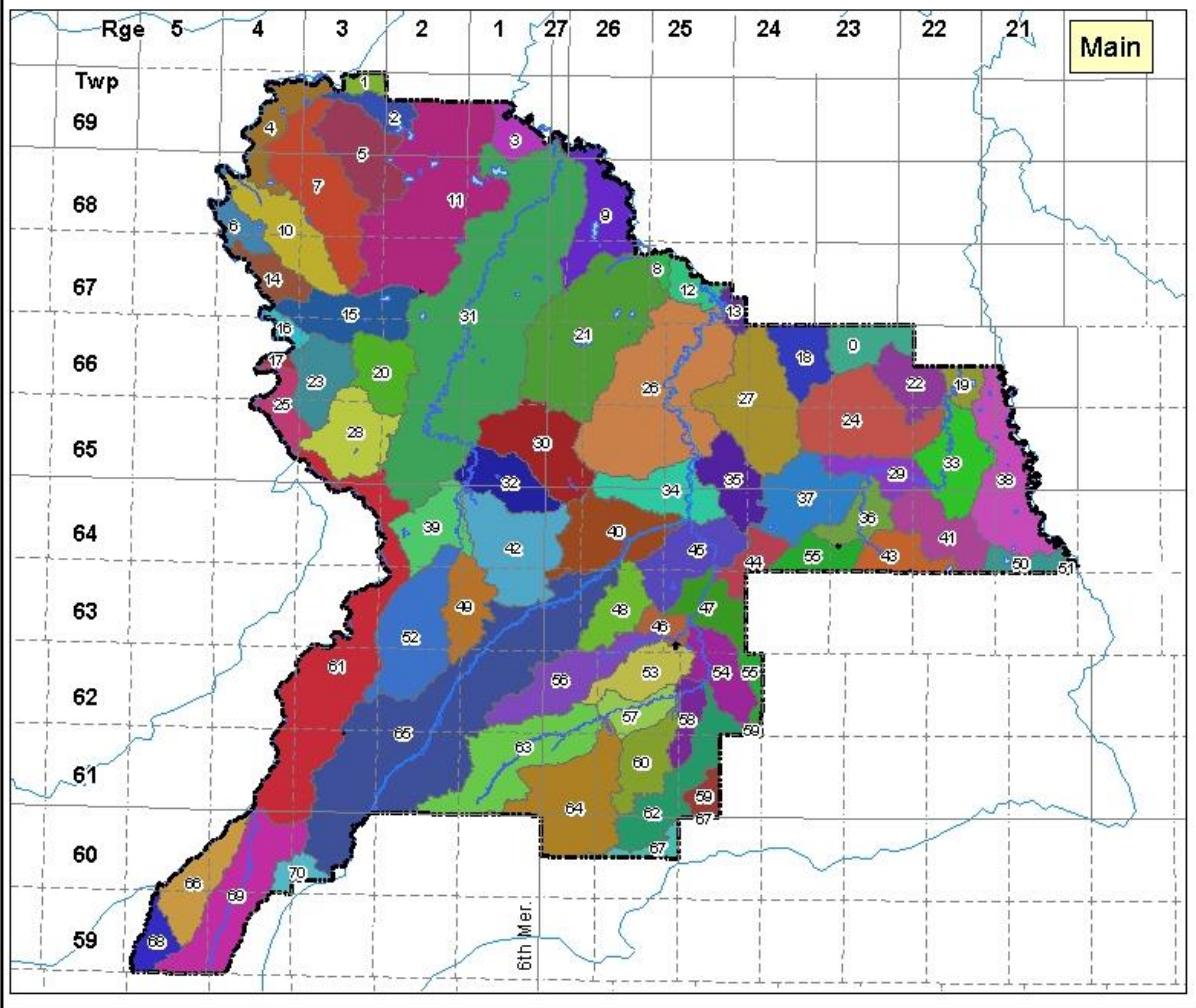


Figure 19 Canfor FMA Watersheds

3.1.2.6 Hydrology

There are three water stations monitored by the Water Survey of Canada located in Canfor's FMA area. These stations provide current and historical data on water levels and streamflow (Environment Canada, 2015c). The following figures depict the monthly mean water discharge and historical peak flows of the Deep Valley Creek (Figure 20 & Figure 21), Waskahigan Creek (Figure 22 & Figure 23), and Simonette River (Figure 24 & Figure 25). This data identifies the time of year peak flows can be expected as well as provide historical information of flood events for those watersheds on the FMA area.

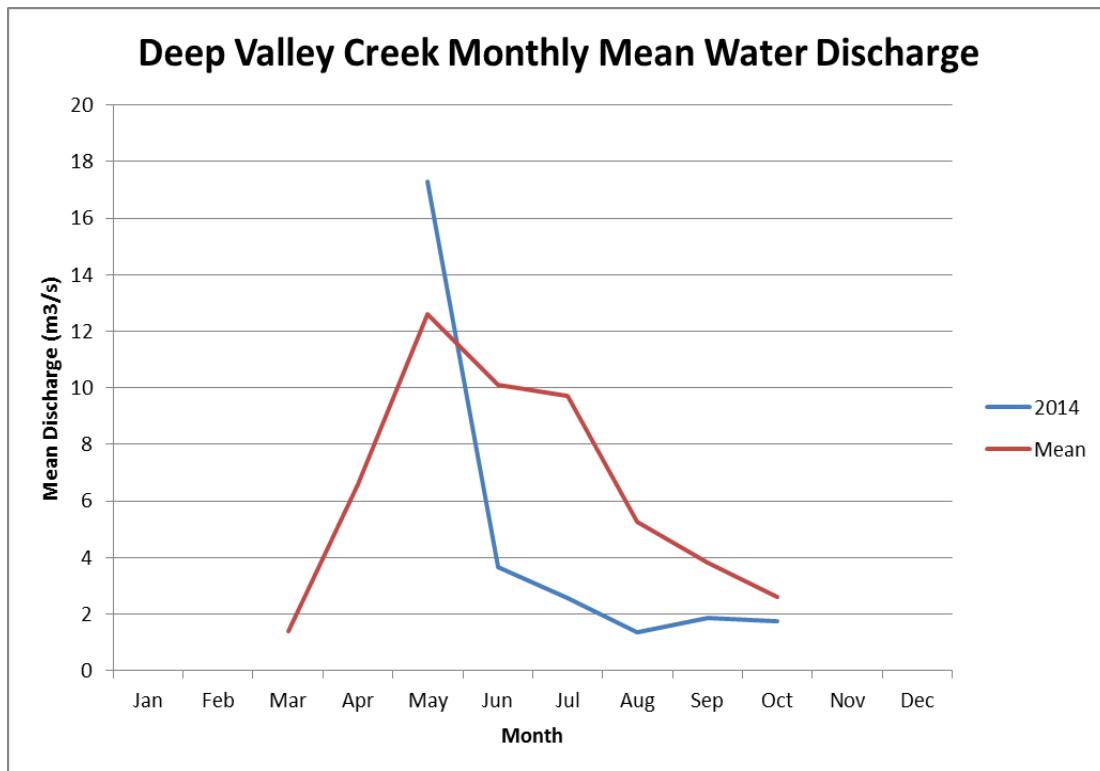


Figure 20 Deep Valley Creek Monthly Mean Water Discharge

Data Source: (Environment Canada, 2015c)

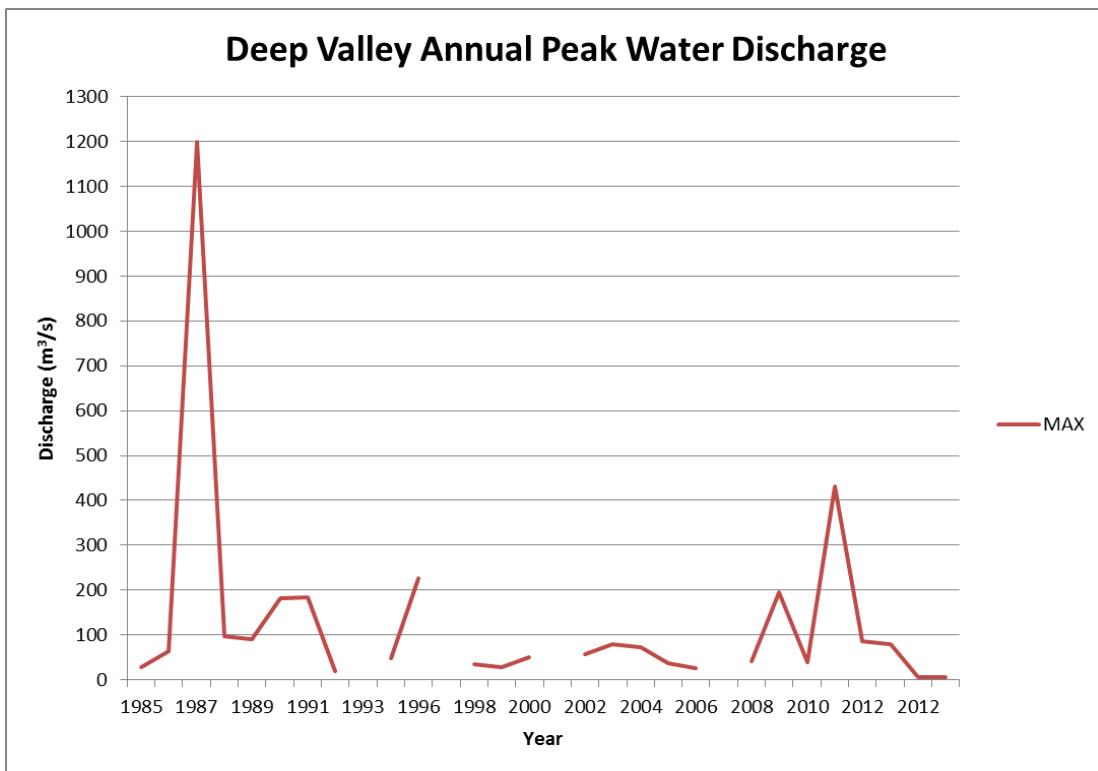


Figure 21 Deep Valley Annual Peak Water Discharge

Data Source: Environment Canada

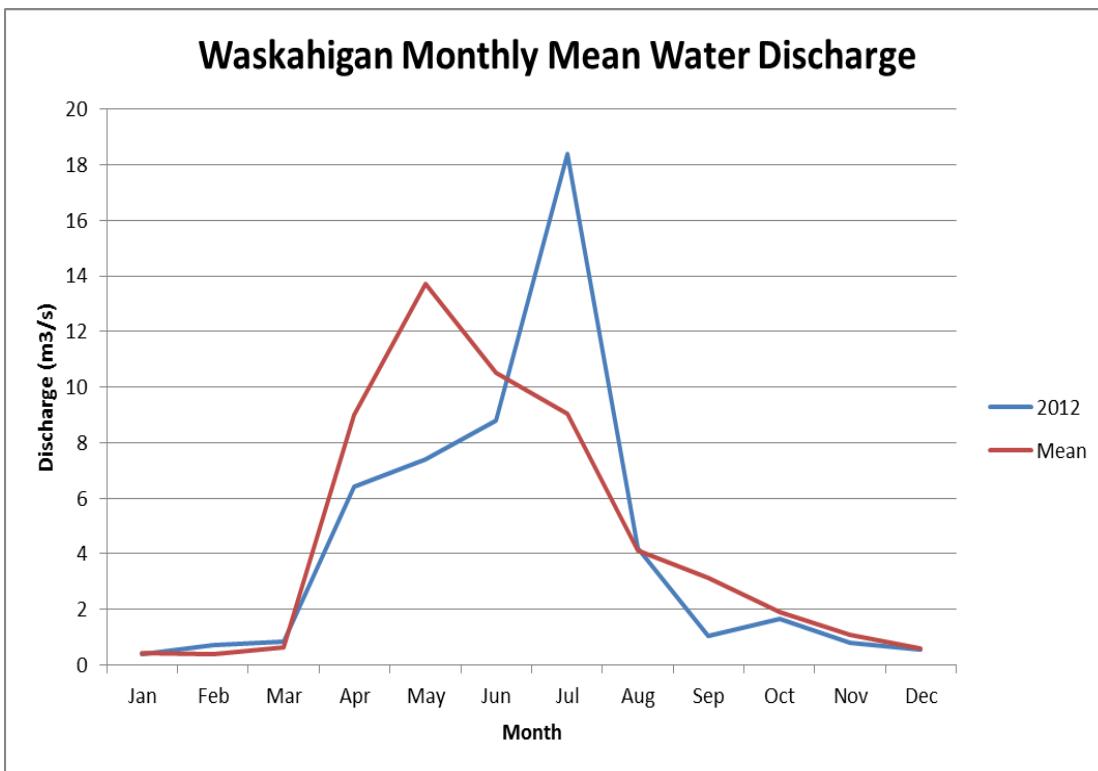


Figure 22 Waskahigan Monthly Mean Water Discharge

Data Source: (Environment Canada, 2015c)

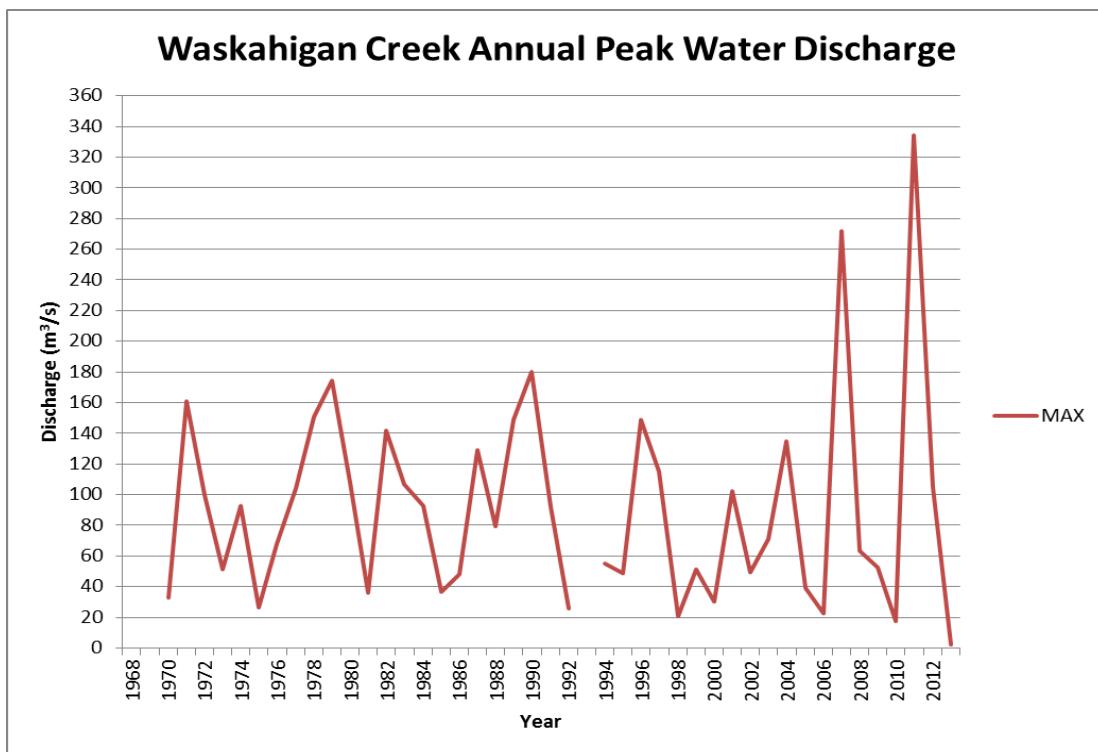


Figure 23 Waskahigan Creek Annual Peak Water Discharge

Data Source: (Environment Canada, 2015c)

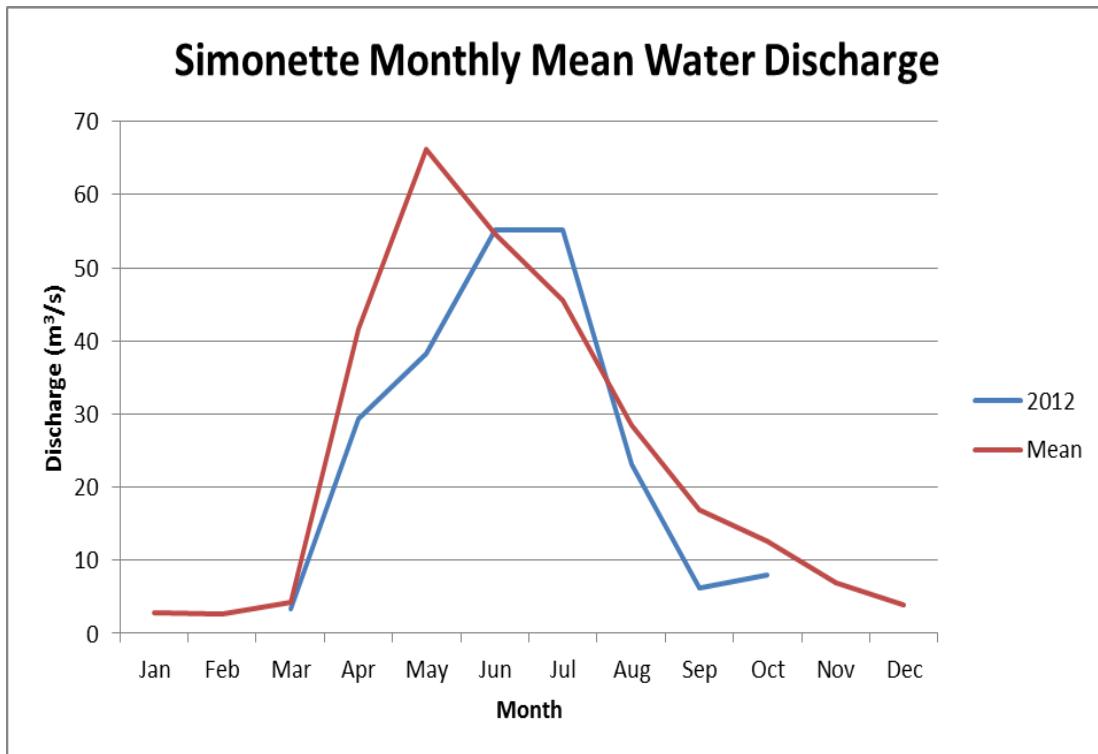


Figure 24 Simonette Monthly Mean Water Discharge

Data Source: (Environment Canada, 2015c)

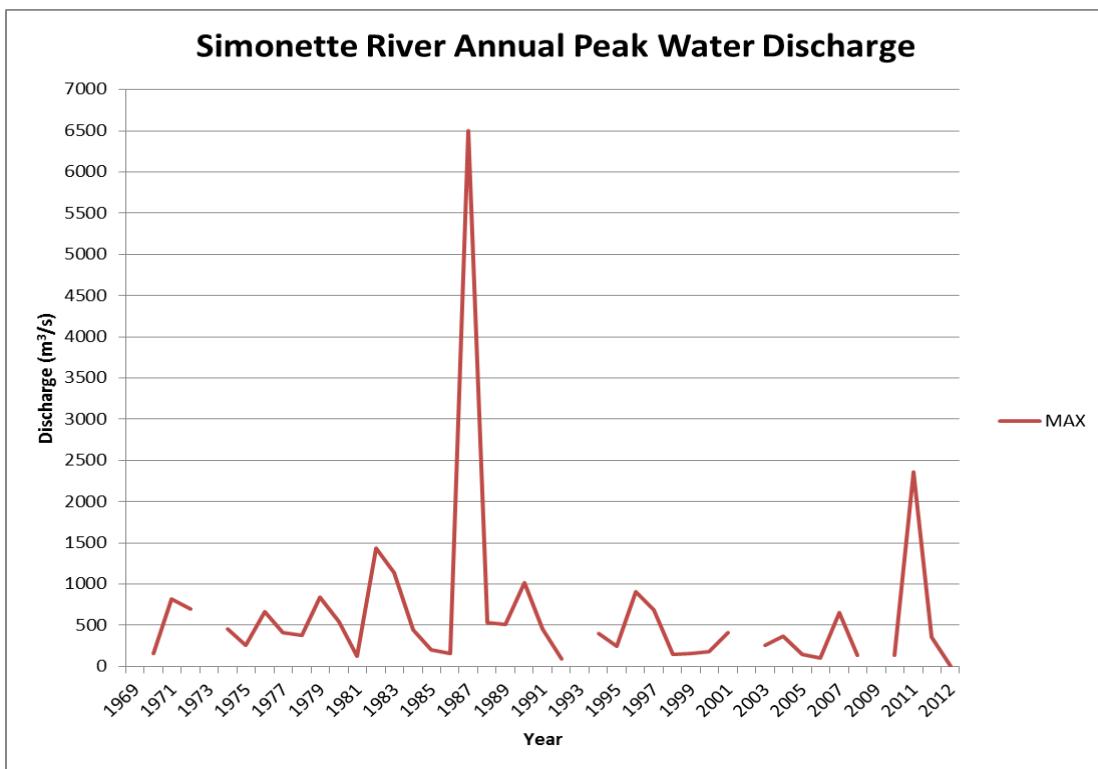


Figure 25 Simonette River Annual Peak Water Discharge

Data Source: (Environment Canada, 2015c)

3.1.2.7 Climate

As described in 3.1.2.2 Natural Regions, Canfor's FMA area is comprised of 3 Natural Regions. The climate for the FMA area varies between these Natural Regions and Subregions as described below.

Climate for Boreal Forest Natural Region

The Boreal Forest Natural Region is the biggest portion in the FMA area. It is associated with long, cold winters and short, rainy summers. As for the winter, the average daily temperature is below -10°C for at least four months of a year. The mean annual temperature is less than 2°C, even in its warmest Dry Mixedwood Subregion (Downing & Pettapiece, 2006). Not any Subregion within the Boreal Forest Natural Region has more than 3 months of mean daily temperature that is greater than 15°C. Since the summers are short, precipitation is highly concentrated in the summer months. 60% to 70% of the precipitation falls between April and August, peaking in July (Downing & Pettapiece, 2006).

Central Mixedwood

Approximately 25% of the province of Alberta is classified as Central Mixedwood Natural Subregion and it is the most common Subregion in the FMA area (Downing & Pettapiece, 2006). The mean annual temperatures for summer and winter are 13.5°C and -13°C, respectively. The mean annual precipitation is 397mm (Moisey, Young, Lawrence, Stone, & Willoughby, 2012). Figure 26 shows the distribution of average temperature and annual precipitation for the Central Mixedwood Subregion.

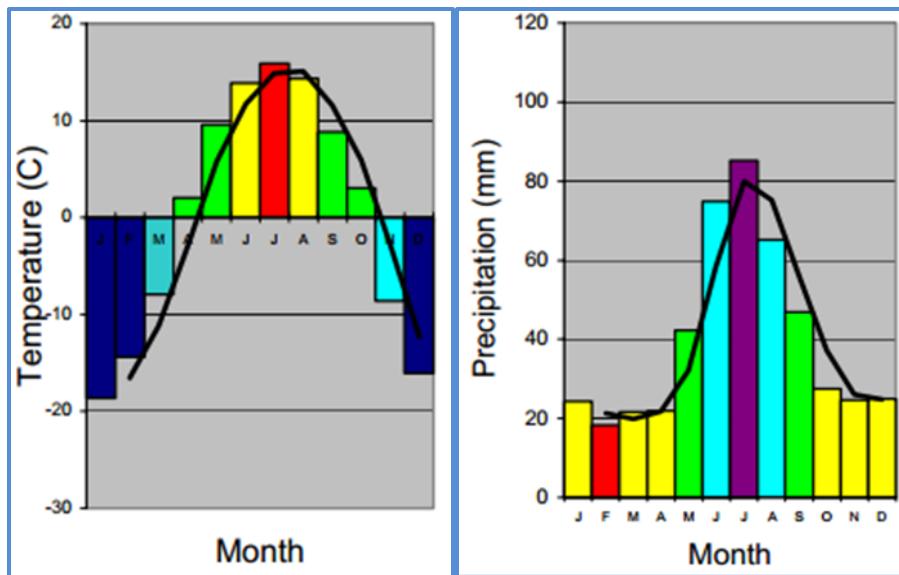


Figure 26 Central Mixedwood Natural Subregion Mean Monthly Temperature (LHS) and Precipitation (RHS)

Source: (Downing & Pettapiece, 2006)

Dry Mixedwood

The Dry Mixedwood Natural Subregion comprises nearly 7% of the FMA and is present in all three parts of the FMA area. Geographically, this Subregion is located at the most southern area of the Boreal Forest Natural Region. The FMA area is in the relatively coolest area of the three Dry Mixedwood sections of the province. It has warmer temperatures than other subregions, which contributes to the higher number of “growing degree-days” for vegetation (Strong & Thompson, 1995), (Downing & Pettapiece, 2006). The average summer and winter temperatures are 13.8°C and -10.5°C, respectively. The average annual precipitation is 380mm (17mm less than Central Mixedwood). The monthly graphs for both mean temperature and precipitation are illustrated in Figure 27.

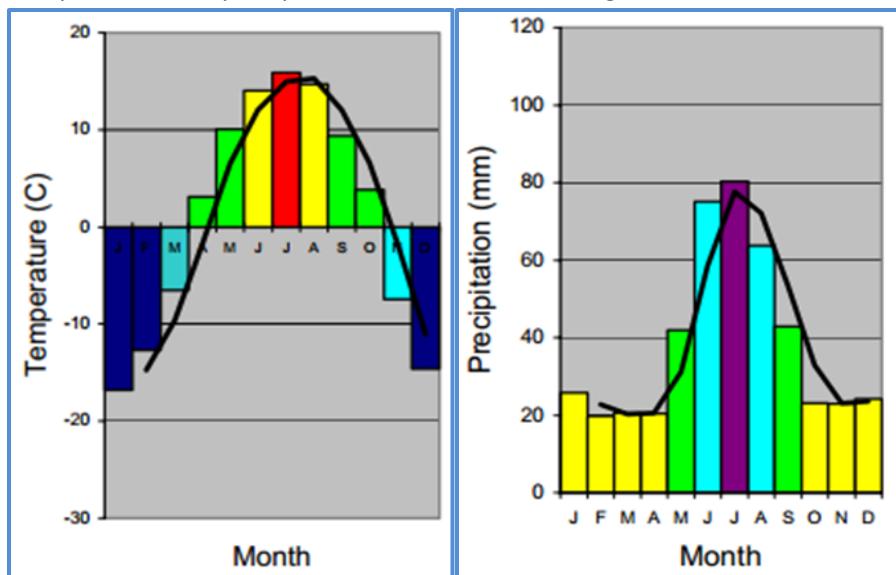


Figure 27 Dry Mixedwood Natural Subregion Mean Monthly Temperature (LHS) and Precipitation (RHS)

Source: (Downing & Pettapiece, 2006)

Climate for Foothills Natural Region

The Foothills Natural Region comprises about 10% of the Province. Just less than 45% of the FMA is classified as Foothills Natural Region. The climate in the region is largely associated with the topographical features, which result in a wet and cool climate (Downing & Pettapiece, 2006), (Heritage Community Foundation, 2010). The Foothills Subregions have the highest mean precipitation on the FMA area (Downing & Pettapiece, 2006).

Lower Foothills

The Lower Foothills Subregion represents more than 30% of the FMA area. It tends to have a higher variation of temperatures between summer and winter seasons (Lawrence, Lance, Willoughby, Hincz, & Stone, 2005). The mean summer and winter temperature is 12.8 °C and -7.8°C respectively. Two thirds of the precipitation falls during the summer months in the Lower Foothills. The mean annual precipitation is 464mm (Lawrence, Lance, Willoughby, Hincz, & Stone, 2005). The abundant moisture content on the ground provides advantages for the growth of coniferous species such as Lodgepole Pine (Lawrence, Lance, Willoughby, Hincz, & Stone, 2005), (Downing & Pettapiece, 2006). The monthly average temperature and precipitation are demonstrated in Figure 28.

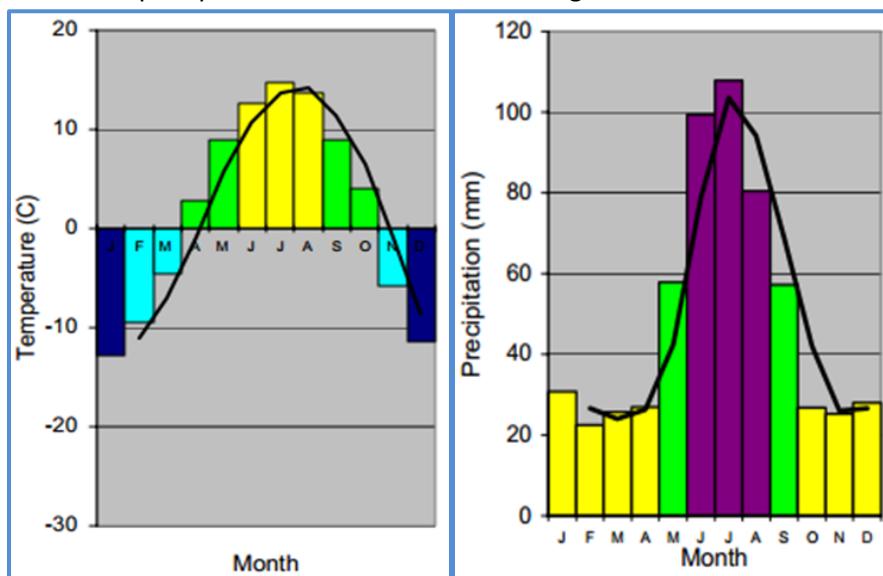


Figure 28 Lower Foothills Natural Subregion Mean Monthly Temperature (LHS) and Precipitation (RHS)
Source: (Downing & Pettapiece, 2006)

Upper Foothills

This Subregion is significantly influenced by the Rocky Mountains (Willoughby, 2007). The Upper Foothills Subregion has cooler summers and milder winters compared to the Lower Foothills Subregion. The mean summer and winter temperatures are 11.5°C and -6.0°C, respectively. The Upper Foothills Subregion also receives more precipitation, especially in July. The average precipitation in July is greater than any other Subregion in the province (Downing & Pettapiece, 2006). The average annual precipitation is 538mm (Willoughby, 2007). Summaries of the mean monthly temperature and precipitation are shown in Figure 29.

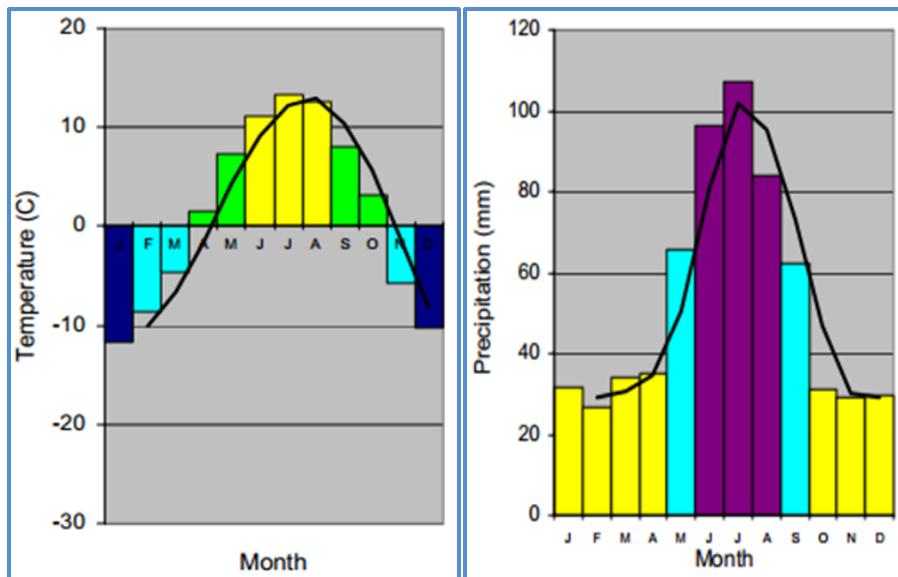


Figure 29 Upper Foothills Natural Subregion Mean Monthly Temperature (LHS) and Precipitation (RHS)

Source: (Downing & Pettapiece, 2006)

Climate for Rocky Mountain Natural Region

The Rocky Mountain Natural Region is located at the southern half of the Alberta-British Columbia border, along the Rocky Mountains. In the FMA area, only 0.7% of the land is classified as Rocky Mountain Natural Region. The unique terrain and mountain climate separate itself from the rest of the Alberta, and even the rest of the Prairies (Heritage Community Foundation, 2010). In general, compared to other regions, the Rocky Mountain Natural Region has the coolest summer and highest annual precipitation, which results the shortest growing season and the highest amount of snow in the winter (Downing & Pettapiece, 2006). Within the region, altitude and aspect are the two determining factors for regional climate variation and accordingly, three Subregions were developed (Heritage Community Foundation, 2010).

Subalpine

The Subalpine Subregion has the highest elevation that is suitable for tree growth (Downing & Pettapiece, 2006). The Subalpine Subregion has cool summers and long winters compared to other Subregions. The mean summer temperature is 9.4 °C for summer and -8.9°C for winter (Willoughby & Alexander, 2006). High amounts of precipitation are observed in this Subregion, particularly in winter. Strong (1992) stated that the winter precipitation in this Subregion is greater than any other. The summer also has large amounts of precipitation, with its annual peak in July. The average annual precipitation is 755mm (Downing & Pettapiece, 2006). Summaries of the mean monthly temperature and precipitation are shown in Figure 30.

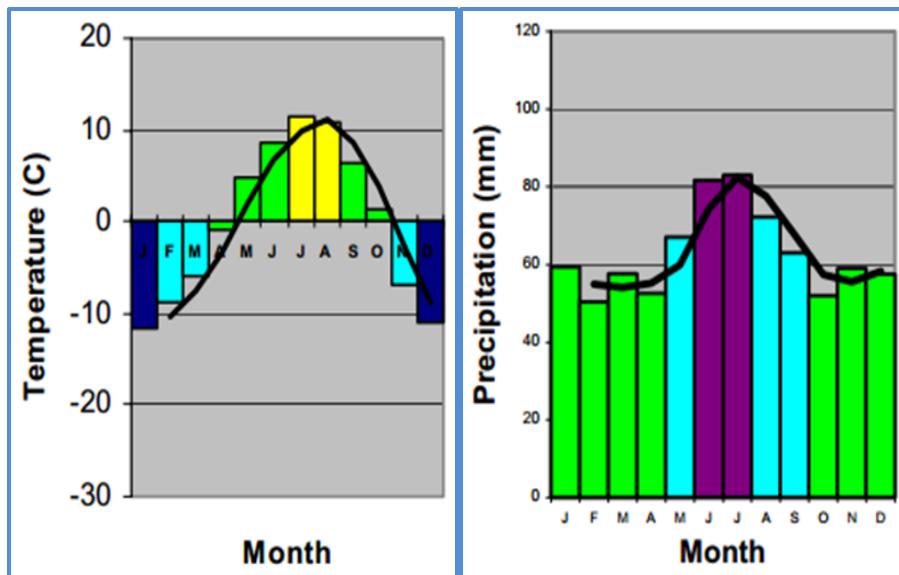


Figure 30 Subalpine Natural Subregion Mean Monthly Temperature (LHS) and Precipitation (RHS)

Source: (Downing & Pettapiece, 2006)

3.1.3 FOREST LANDSCAPE PATTERN AND STRUCTURE

3.1.3.1 Forest Species

There are eight primary species within the FMA area – five coniferous and three deciduous (Figure 31). Approximately 56% of the trees on Canfor's FMA area are coniferous and 44% are deciduous. White Spruce is the most common coniferous species and Trembling Aspen is the most common of the deciduous species (Figure 32).

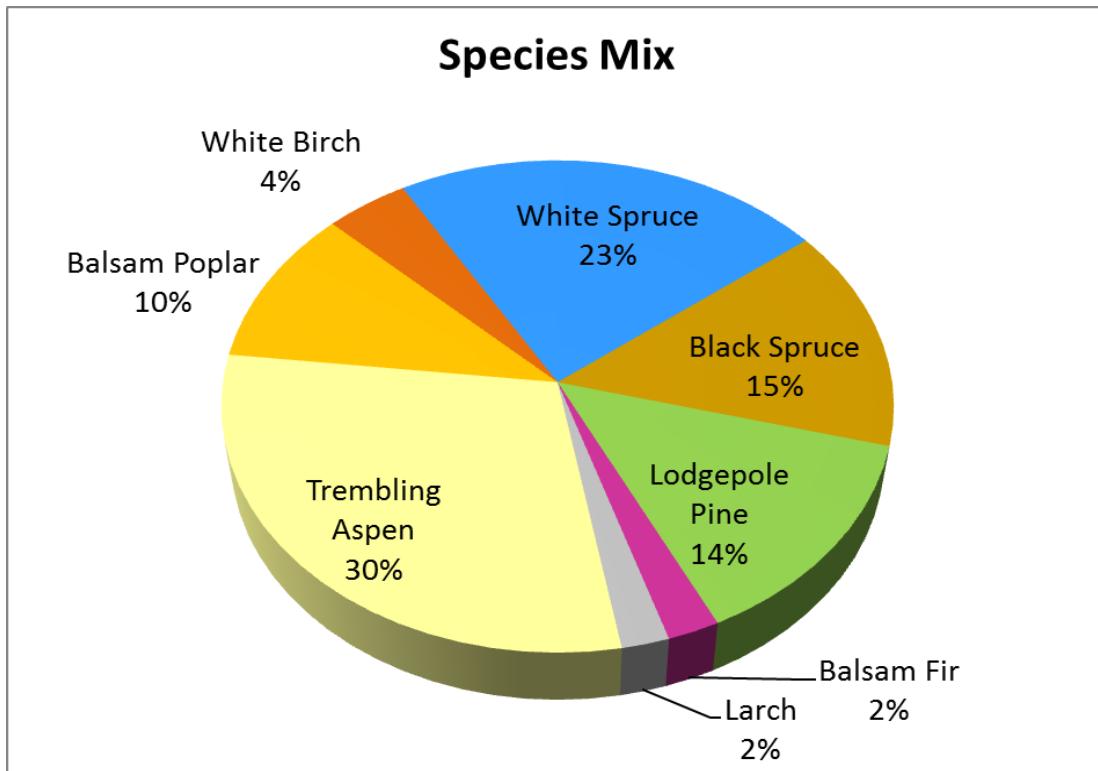


Figure 31 FMA Area Species Mix

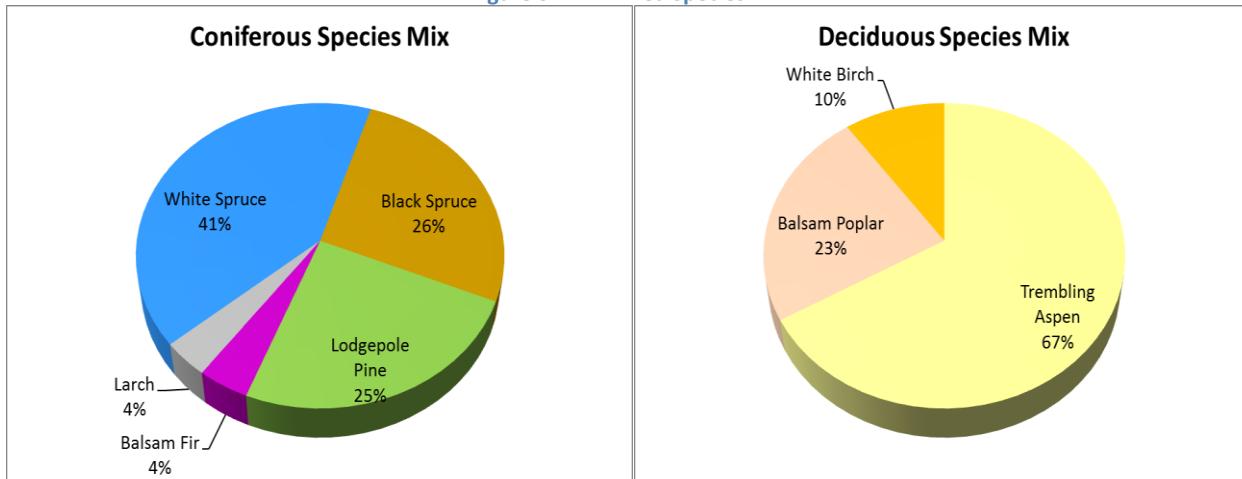


Figure 32 Coniferous Species Mix (LHS) and Deciduous Species Mix (RHS)

3.1.3.2 Forest Cover-types

Canfor's seventeen yield groups are assigned Broad Cover Groups (BCG) based on their leading species composition. These broad cover group classifications are:

- Coniferous (C) - stands with at least 80% coniferous;
- Coniferous/Deciduous (CD) - stands where the coniferous component is at least 50% and less than 80%;
- Deciduous/Coniferous (DC) - stands where the deciduous component is at least 50% and less than 80%;

- Deciduous (D) - stands with at least 80% deciduous; and
- Deciduous/Coniferous Understory (Du) - stands with at least 80% deciduous and have a coniferous understory of 100 stems/ha.

Coniferous species are predominate in the southern part of the FMA area and deciduous species are predominate in the northern part of the FMA area (Figure 33). Table 4 to Table 8 indicate the amount of area by BCG in the FMA area.

Table 4 FMA Area Broad Cover Groups

Gross			THLB		
Broad Cover Group	Area (Ha)	Percent Area	Broad Cover Group	Area (Ha)	Percent Area
C	266,590	44%	C	181,643	38%
CD	68,665	11%	CD	62,628	13%
D	74,234	12%	D	55,356	12%
DC	91,156	15%	DC	85,023	18%
Du	101,640	17%	Du	95,925	20%
Total	602,285	100%	Total	480,575	100%

Table 5 Natural Region Broad Cover Groups (Gross Area)

Broad Cover Group	Area (Ha)			Percent Area		
	Boreal	Foothills	Rocky Mountain	Boreal	Foothills	Rocky Mountain
C	82,709	179,798	4,084	25%	66%	97.8%
CD	39,953	28,645	67	12%	10%	1.6%
D	63,792	10,428	13	20%	4%	0.3%
DC	62,929	28,216	11	19%	10%	0.3%
Du	75,269	26,370	1	23%	10%	0.0%
Total	324,652	273,457	4,176	100%	100%	100%

Table 6 Natural Region Broad Cover Groups (THLB Area)

Broad Cover Group	Area (Ha)			Percent Area		
	Boreal	Foothills	Rocky Mountain	Boreal	Foothills	Rocky Mountain
C	44,380	133,996	3,267	25%	66%	97.8%
CD	36,516	26,069	42	12%	10%	1.6%
D	47,496	7,851	9	20%	4%	0.3%
DC	59,074	25,941	8	19%	10%	0.3%
Du	71,191	24,734	0	23%	10%	0.0%
Total	324,652	273,457	4,176	100%	100%	100%



Table 7 FMA Parcel Broad Cover Group (Gross Area)

Broad Cover Group	Area (Ha)			Percent Area		
	Main	Peace	Puskwaskau	Main	Peace	Puskwaskau
C	250,711	4,352	11,527	48.7%	19.2%	17.8%
CD	55,017	2,859	10,790	10.7%	12.6%	16.7%
D	59,594	7,006	7,634	11.6%	30.9%	11.8%
DC	73,629	3,493	14,034	14.3%	15.4%	21.7%
Du	75,867	4,991	20,782	14.7%	22.0%	32.1%
Total	514,817	22,702	64,766	100%	100%	100%

Table 8 FMA Parcel Broad Cover Group (THLB Area)

Broad Cover Group	Area (Ha)			Percent Area		
	Main	Peace	Puskwaskau	Main	Peace	Puskwaskau
C	171,824	3,451	6,367	42.4%	18.2%	11.3%
CD	49,937	2,398	10,294	12.3%	12.7%	18.2%
D	43,600	5,576	6,179	10.8%	29.5%	10.9%
DC	68,523	3,002	13,497	16.9%	15.9%	23.9%
Du	71,314	4,502	20,110	17.6%	23.8%	35.6%
Total	405,199	18,930	56,447	100%	100%	100%

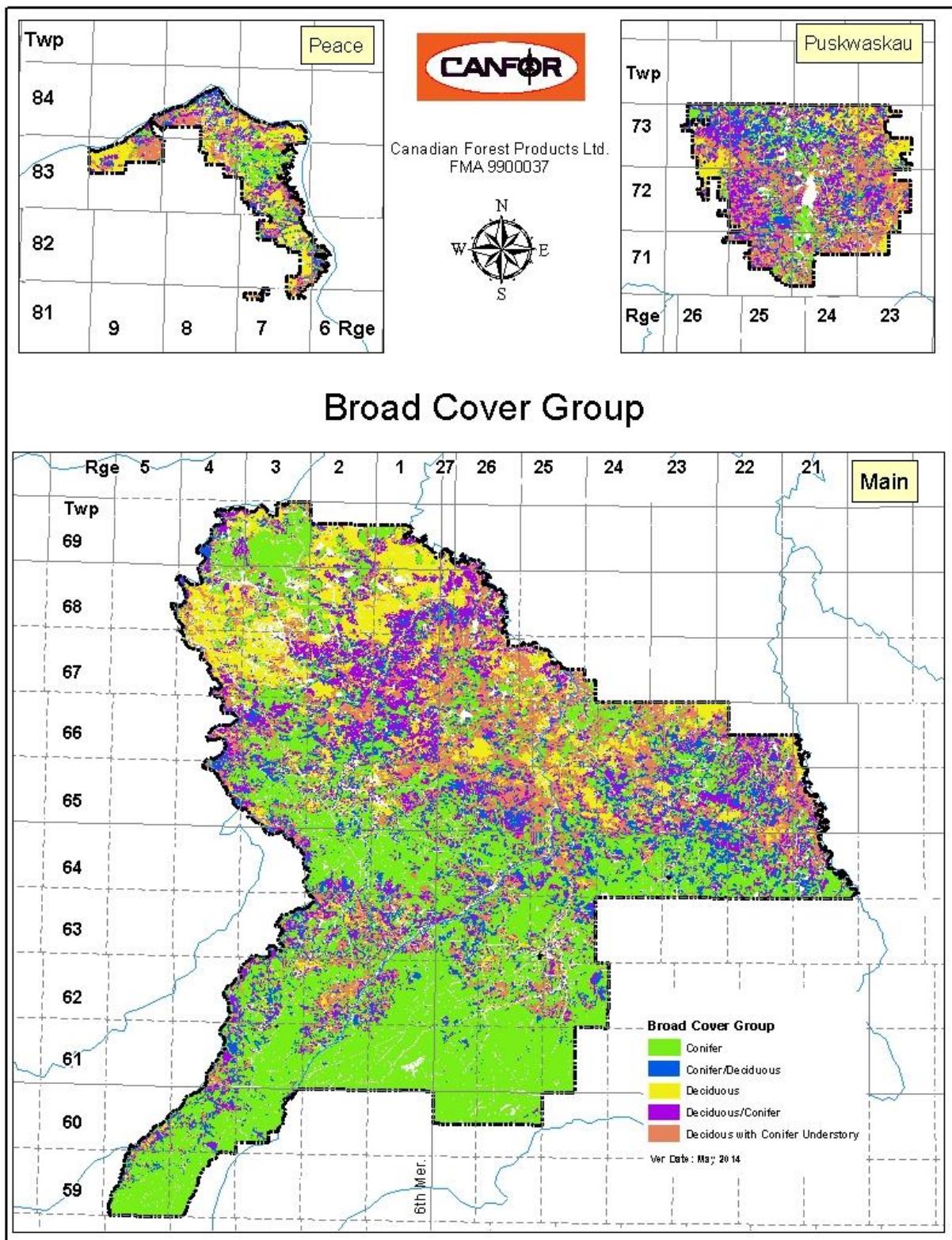


Figure 33 Broad Cover Group

3.1.3.3 Forest Age Classes

Forest age classes are a coarse filter indicator of biodiversity. There have been very few natural forest fires since the intervention of fire protection and forest management in the sixties. The following tables show the current age class distribution of the forest for the timber harvest landbase, non-timber harvest landbase and total FMA area (Figure 34) for the Peace, Puskwaskau and Main parcels, Boreal and Foothills, and Rocky Mountain Natural Regions. The age class forecasts based on the spatial harvest sequence are included in the TSA Appendix J.

Table 9 Current FMA Area Age Class Distribution

Landbase Description	Area (ha) by Age Class (Yrs)							
	0-20	21-40	41-60	61-80	81-100	100-120	121+	Total
THLB	57,896	37,726	54,442	89,145	85,404	79,674	76,288	480,575
Non-THLB	864	2,492	5,080	13,955	26,888	29,265	43,165	121,709
Total	58,760	40,218	59,522	103,100	112,292	108,940	119,453	602,284

Table 10 Current Peace Parcel Age Class Distribution

Landbase Description	Area (ha) by Age Class (Yrs)							
	0-20	21-40	41-60	61-80	81-100	100-120	121+	Total
THLB	2,122	190	3,399	8,826	3,444	144	806	18,930
Non-THLB	43	18	514	1,655	939	143	459	3,772
Total	2,164	208	3,913	10,481	4,383	287	1,265	22,702

Table 11 Current Puskwaskau Parcel Age Class Distribution

Landbase Description	Area (ha) by Age Class (Yrs)							
	0-20	21-40	41-60	61-80	81-100	100-120	121+	Total
THLB	5,268	5,457	12,135	18,447	5,266	4,733	5,140	56,447
Non-THLB	7	174	580	2,616	1,517	1,966	1,461	8,319
Total	5,275	5,631	12,715	21,062	6,782	6,699	6,601	64,766

Table 12 Current Main Parcel Age Class Distribution

Landbase Description	Area (ha) by Age Class (Yrs)							
	0-20	21-40	41-60	61-80	81-100	100-120	121+	Total
THLB	50,506	32,079	38,907	61,873	76,695	74,797	70,342	405,199
Non-THLB	814	2,300	3,986	9,684	24,432	27,156	41,245	109,618
Total	51,320	34,380	42,893	71,557	101,127	101,953	111,586	514,817

Table 13 Current Boreal Natural Region Age Class Distribution

Landbase Description	Area (ha) by Age Class (Yrs)							
	0-20	21-40	41-60	61-80	81-100	100-120	121+	Total
THLB	23,130	11,109	36,209	65,933	54,351	41,109	26,816	258,657
Non-THLB	250	1,051	3,450	10,260	18,650	17,444	14,887	65,993
Total	23,380	12,159	39,659	76,193	73,001	58,553	41,704	324,650

Table 14 Current Foothills Natural Region Age Class Distribution

Landbase Description	Area (ha) by Age Class (Yrs)							
	0-20	21-40	41-60	61-80	81-100	100-120	121+	Total
THLB	33,748	26,455	18,222	23,199	30,866	37,262	48,840	218,592
Non-THLB	606	1,427	1,630	3,692	8,183	11,354	27,975	54,867
Total	34,354	27,882	19,852	26,891	39,049	48,617	76,814	273,459

Table 15 Current Rocky Mountain Age Class Distribution

Landbase Description	Area (ha) by Age Class (Yrs)							
	0-20	21-40	41-60	61-80	81-100	100-120	121+	Total
THLB	1,018	162	10	13	187	1,303	632	3,327
Non-THLB	8	15	0	3	55	466	303	849
Total	1,026	177	11	16	242	1,769	935	4,176

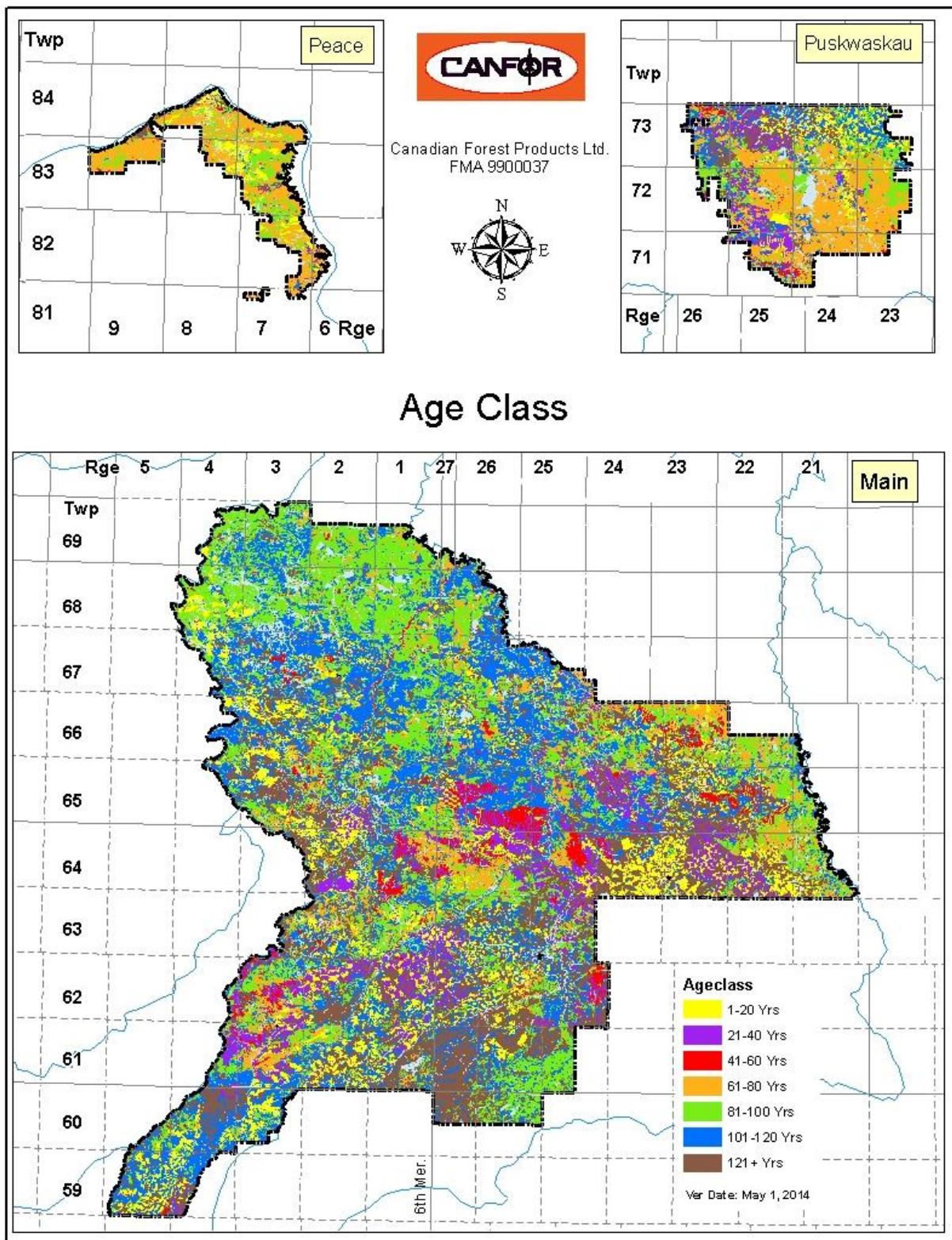


Figure 34 Current Age Class Distribution

3.1.3.4 Seral Stages

Seral stage distribution “is important for the conservation of biodiversity because it enables timber harvests to be planned so as to maintain a full range of successional habitats for wildlife and ecosystem types over the long-term” (CCFM, 1997). Seral stages are identified as the stages in forest succession that align with ecological succession that occurs after a major disturbance such as fire.

The five seral stage categories identified in Table 16, have defined age ranges depending on the yield group to which a stand belongs. These age ranges reflect total stand age and have been adjusted from previous analyses to include the years to breast height and to be consistent with the yield curves used in the timber supply model.

Table 16 Canfor FMA Area Seral Stage Definitions

Yield Group	Species	Seral Stage Categories (Yrs)					Years to BH
		Pioneer	Young	Mature	O.Mature	Old	
1	AW	0-6	7-26	27-76	77-116	117+	6
2	AW	0-6	7-26	27-76	77-116	117+	6
3	SW	0-15	16-55	56-95	96-135	136+	15
4	BW	0-6	7-26	27-76	77-116	117+	6
5	FB	0-15	16-55	56-115	116-135	136+	15
6	SW	0-15	16-55	56-95	96-135	136+	15
7	PB	0-6	7-26	27-86	87-116	117+	6
8	PL	0-10	11-50	51-90	91-130	131+	10
9	PL	0-10	11-40	41-80	81-130	131+	10
10	PL	0-10	11-50	51-100	101-130	131+	10
11	PL	0-10	11-50	51-100	101-130	131+	10
12	SB	0-20	21-70	71-150	151-170	171+	20
13	SB	0-20	21-70	71-160	161-180	181+	20
14	SB	0-20	21-60	61-120	121-150	151+	20
15	SW	0-15	16-55	56-105	106-135	136+	15
16	SW	0-15	16-55	56-105	106-135	136+	15
17	SW	0-15	16-55	56-105	106-135	136+	15

The landbase summaries from the Alberta Vegetation Inventory (AVI) provide the amount of pioneer, young, mature, and old forest that is currently distributed on Canfor’s FMA area. The current distribution of gross forest landbase is illustrated in Table 17 and Table 18. (Note: Since the Rocky Mountain Natural Range represents a small portion of the FMA area, it has been lumped into the Foothills Natural Range for seral stage reporting)

In order to maintain biodiversity across the landscape through the planning horizon, Canfor has implemented seral stage targets in the Timber Supply Analysis (TSA) (Section 7.2.1.1.4) and developed forecast projections based on the TSA (Appendix J).

Table 17 Current Seral Stage Distribution by Natural Region

Natural Region	Seral Stage Percent by Natural Region (% Area)					FRI
	Pioneer	Young	Mature	O. Mature	Old	
Boreal	5	8	55	28	4	60
Foothills	10	19	32	28	11	80
FMA Area	6	11	40	28	14	

Table 18 Current Seral Stage Distribution by Cover Class

Cover Class	Seral Stage by Cover Class (ha)					
	Pioneer	Young	Mature	O.Mature	Old	Total
C_PL	12,251	16,828	22,666	30,501	9,179	91,424
C_SB	1,523	234	14,241	1,784	910	18,691
C_SW	11,508	17,468	25,876	23,524	17,283	95,659
D	4,080	718	24,799	41,502	3,136	74,233
MIXED_PL	1,765	4,737	3,972	8,435	1,328	20,237
MIXED_SW	6,694	28,444	149,198	48,672	8,191	241,199
none*	120	81	756	14,689	45,196	60,842
Total	37,941	68,510	241,508	169,107	85,223	602,285

* none = non productive C_Sb (YG 13)

3.1.3.5 Forest Patches

The maintenance of a diversity of forested patch sizes on the landscape is a measure of ecosystem diversity. Canfor's FMA area is subject to lineal disturbances such as roads, pipelines, and seismic lines that all fragment patches. Canfor's FMA area patch size distribution based on 40m adjacent distance⁴ and 8m adjacent distance is illustrated in Table 19.

Table 19 Current Patch Size Distribution

40m Adjacency			8m Adjacency			
Reporting Areas	% of Area by Patch Size Class		Reporting Areas	% of Area by Patch Size Class		
	0-100ha	100-500ha		0-100ha	100-500ha	
FMA Area	59	36	5	FMA Area	80	20
Peace	46	29	25	Peace	86	14
Puskwaskua	68	32	0	Puskwasku	85	15
Main	59	36	5	Main	79	21

⁴ The adjacent distance refers to the maximum distance between two polygons that can be considered part of the same patch. Patch size targets have been developed for the FMA area as part of Canfor's SFMP based on a 40m adjacent distance. AESRD's Alberta Forest Management Planning Standard specifies an adjacent distance of 8m to be used. The Timber Supply Analysis (Appendix J) will include both 40m and 8m patch size distributions.

3.1.4 FOREST LANDSCAPE DISTURBANCE AND SUCCESSION

3.1.4.1 Inherent Disturbance Regime

Forest health can be influenced by many natural disturbance agents including fire, insects, disease, as well as natural calamities which include weather events such as flooding, hail, and strong winds. Canfor's FMA area has been exposed to all of these disturbances at one point or another through the occurrence of stochastic natural events.

For further details on the occurrence, size, and frequency of recent natural disturbance on Canfor's FMA area refer to Sections 3.1.4.3 (Insects and Diseases); 3.1.5 (Fire); and 9.1.1.2 (Natural Calamities).

3.1.4.2 Uncommon Plant Communities

Uncommon plant communities are important to biological diversity as they represent rare ecosystems that exist on the landscape. The Alberta Conservation Information Management System website provides information on the type and potential location of uncommon plant communities. Currently, there are no known sensitive plant communities on the FMA area and there is one identified non-sensitive plant community on the FMA area (Table 20 and Figure 35). All identified un-common forested/woodland plant communities are excluded from harvest operations.

Indicator 1.1.1 from Canfor's 2012 Sustainable Forest Management Plan (Appendix H) (See Section 9 for correlation with Annex 4), have been developed to ensure uncommon plant communities are maintained on Canfor's FMA area.

Table 20 Known Uncommon Plant Communities on Canfor's FMA Area⁵

Type	S_RANK	SNAME	Common Name
Non-sensitive	S2S3	<i>Populus tremuloides / Rubus parviflorus / Aralia nudicaulis</i>	Trembling Aspen/thimbleberry/wild sarsaparilla

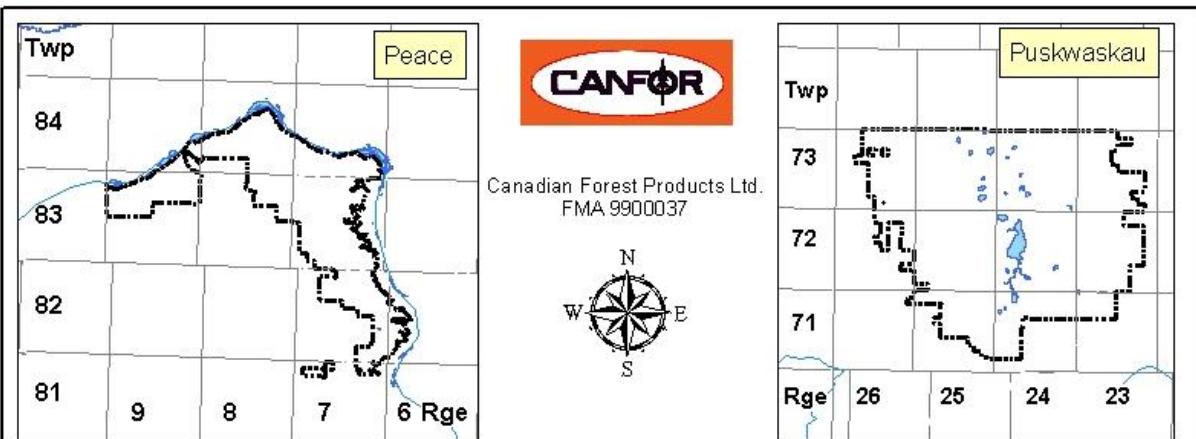
⁵ Uncommon Plant Community Ranking:

S1: Known from five or fewer occurrences or especially vulnerable to extirpation because of other factor(s).

S2: Known from twenty or fewer occurrences or vulnerable to extirpation because of other factor(s).

S3: Known from 100 or fewer occurrences or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors.

S4: Apparently secure



Uncommon Plant Communities

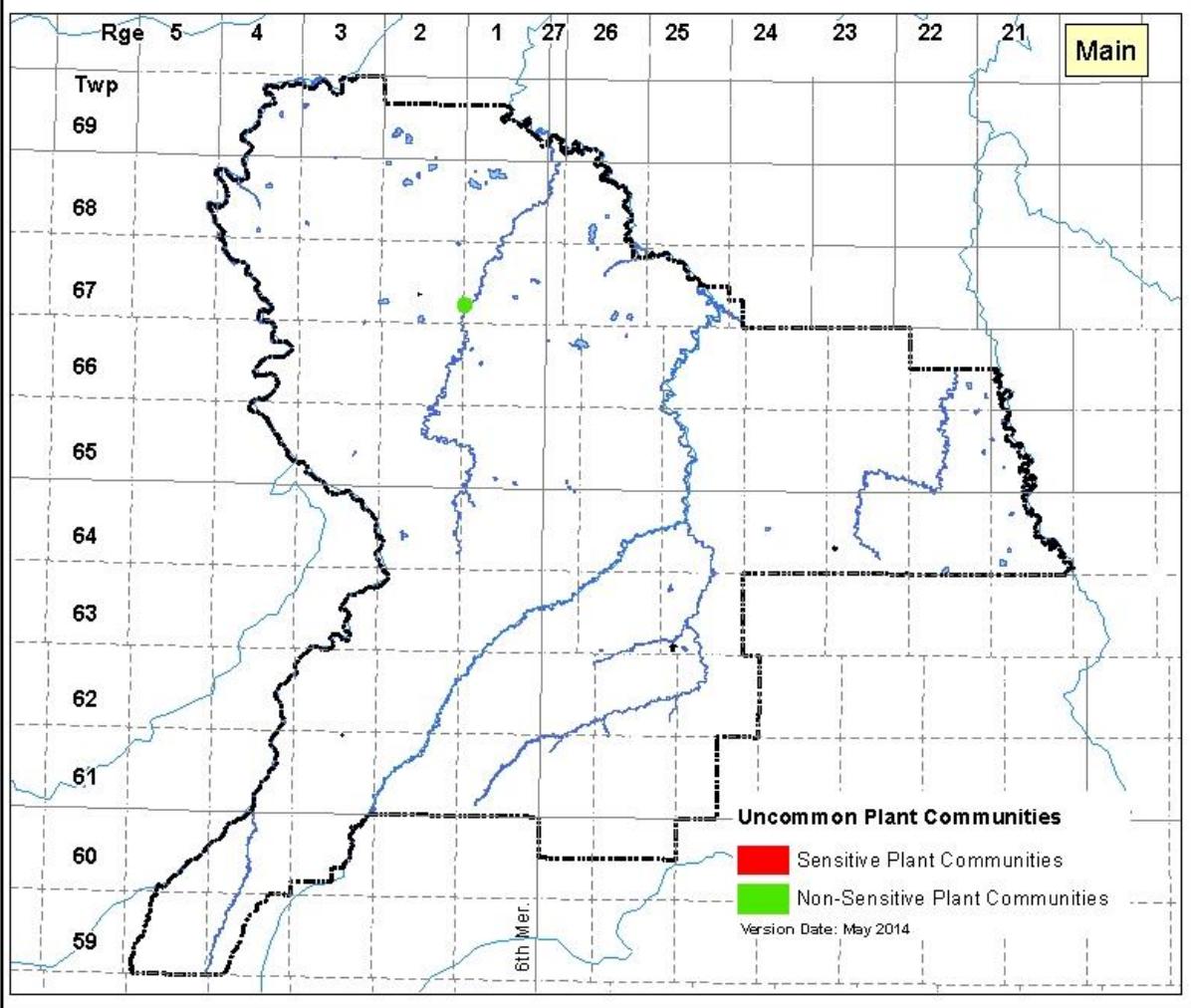


Figure 35 Uncommon Plant Communities on Canfor's FMA Area

3.1.4.3 Insects and Diseases

Insects and diseases play an essential natural ecological role. Most insects and disease persist on the landscape at endemic levels; a problem arises when insect and disease populations rise to epidemic levels. The Alberta Government conducts surveys every year to monitor insects and disease and when an outbreak is detected, more site specific monitoring may occur. When an infestation becomes an epidemic and threatens forest health, the Alberta Government may develop management strategies. Currently, the most common management strategy implemented in the province is the Mountain Pine Beetle program. Table 21 shows the current status of important insect and disease pests in Alberta (Cerezke, Dhir, & Barnhardt, 2013) and an assessment of their presence on Canfor's FMA area based on local knowledge.

Table 21 Insects and Disease

Common Name		Latin Name	Species Impacted	Management Priority	Potential Impact on the Forest Values	Presence on FMA Area
Insect Species	Birch Leaf Miner	<i>Fenusia pusilla</i>	Birch	Low	Low-Moderate	Low
	Mountain Pine Beetle	<i>Dendroctonus ponderosae</i>	Pine	Very High	Severe	Severe
	Spruce Beetle	<i>Dendroctonus rufipennis</i>	Spruce	Moderate	Moderate	Moderate
	Spruce Budworm	<i>Choristoneura fumiferana</i>	Spruce	High	High	Low
	Spruce Cone Maggot	<i>Strobiloomyia neantracina</i>	Spruce	Low	Low	Low
	Forest Tent Caterpillar	<i>Malacosoma</i>	Deciduous	Low	High	High
	Warren Rootcollar Weevil	<i>Hylobius warreni</i>	Pine	Low	Low	Low-Moderate
	White Spotted Sawyer Beetle	<i>Monochamus scutellatus</i>	Spruce	Low	Low-Moderate	Low-Moderate
	Yellow Headed Spruce Sawfly	<i>Pikonema glaskensis</i>	Spruce	Low	Low	Low
Disease species	Armillaria Root Disease	<i>Armillaria ostoyae</i>	Conifer/Deciduous	Moderate-High	Moderate	Moderate
	Atropellis Canker	<i>Atropellis piniphilia</i>	Pine	Low	Low	Low
	Comandra Blister Rust	<i>Chronartium comandrae</i>	Pine	Moderate	Moderate	Moderate
	Dwarf Mistletoe	<i>Arceuthobium americanum</i>	Pine	Moderate	Moderate	Moderate
	Hypoxylon Canker	<i>Hypoxylon mammatum</i>	Aspen	Low	Low	Low-Moderate
	Pine Needle Cast	<i>Lophodermella concolor</i>	Pine	Low	Low	Low
	Red Ring Rott	<i>Phellinus pini</i>	Conifer	Low	Low	Low
	Stalactiform Blister Rust	<i>Cronartium coleosporioides</i>	Pine	Low	Moderate	Moderate
	Tomentosus Root Rot	<i>Inonotus tomentosus</i>	Spruce	Low	Low	Low
	Western Gall Rust	<i>Endochnorartium harknessii</i>	Pine	Moderate	Moderate	Moderate

Source: (Cerezke, Dhir, & Barnhardt, 2013)

At this time, the biggest impact and threat to forest ecosystem productivity on Canfor's FMA area is Mountain Pine Beetle infestation (MPB). The inflight of Mountain Pine Beetle from British Columbia that occurred in 2006 and again in 2009 greatly impacted the Grande Prairie and Peace Region forests. AESRD has an active MPB monitoring, survey, and treatment program in place to address MPB in the region. Canfor also monitors the FMA area annually for MPB progression and has modified harvest plans to focus on infected stands based on monitoring results and recommendations from AESRD.

Mountain Pine Beetle (MPB) is a species of bark beetle native to the forests of Western North America. MPB have always been around in small isolated



Figure 36 Mountain Pine Beetle

Photo Source: David Mah- special to the Vancouver Sun, files

patches, however current climate has allowed the MPB to expand to epidemic levels that poses a threat to all pine in the Canadian Boreal forest. The current outbreak began in 1996 in Tweedsmuir National Park British Columbia. MPB flourished throughout central and interior BC. In 2006 an updraft of wind carried millions of MPB into North Western Alberta, including the Grande Prairie and Peace River regions. The MPB has thrived in these regions due to warm winters and early springs.

MPB infest pine trees by laying eggs under the bark. This creates blue stain fungus in the sapwood that prevents the tree from repelling the beetles with tree pitch flow. A very common indicator that the pine tree has been attacked is popcorn-shaped masses of resin, called pitch tubes. Larval feeding will kill the tree within a few weeks by cutting off the flow of water and nutrients. When the pine is first attacked it will remain green, usually until the following year when the needles will turn red and the tree dies. Approximately 3-4 years after being attacked the dead pine will turn grey.

MPB can significantly impact the quality of timber and health of forests. Millions of hectares of merchantable timber is in jeopardy in Alberta, and has the potential to spread further east across Canada. Recognizing the seriousness of the MPB beetle epidemic in the province, the Government of Alberta developed the *Mountain Pine Beetle Action Plan* in December of 2007. Alberta has identified Leading-edge, Holding and Inactive Holding pine beetle management zones which have different levels of management strategies:

- Leading-edge zone: AESRD will conduct Level 1 treatment (spot cut and burn) to prevent spread along the eastern slopes of the Rocky Mountains and eastwards into the Boreal forest. Level 2 timber harvesting may supplement Level 1;
- Holding Zone: areas with significantly more infested trees than the leading-edge zone. The objective is to reduce or hold the beetle population in check. Each tenure holder will plan and implement Level 2 treatment. Level 1 treatment will supplement these activities where appropriate; and
- Inactive Holding Zone: areas with a large number of infected trees or where treatments would be ineffective. The objective is to use timber harvesting to achieve other forest management goals.

In 2006, AESRD released the *Interpretive Bulletin, Planning Mountain Pine Beetle Response Operations* with a goal of reducing the area of susceptible pine stands in the province to 25% of that projected in



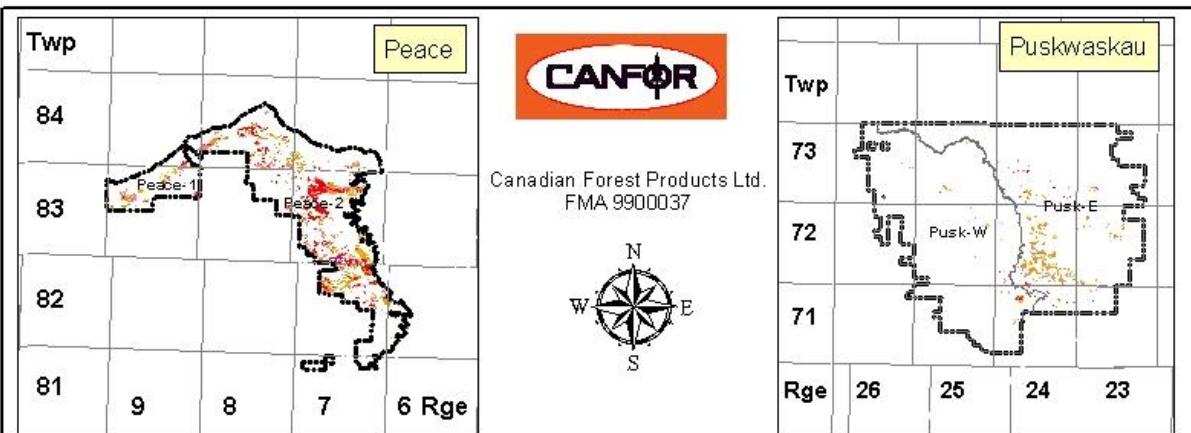
Figure 37 MPB Infested Red Tree



Figure 38 MPB Infected Forest Stand



the current FMP within 20-years (AESRD, 2006b). In accordance with this Interpretive Bulletin, Canfor submitted an amendment to the 2003 DFMP named the Healthy Pine Strategy Amendment, which was approved on May 1, 2009. Since the first infestation in 2006, Canfor has focused their operations on highly infested stands and highly susceptible pine stands. As a result, although not completely stopped, the spread of MPB across the FMA area has not been as significant as initially anticipated. The current MPB Risk on Canfor's FMA is shown in Figure 39. See Section 7.5.1 for the MPB strategies included in the 2015 FMP.



MPB Current Risk Ranking

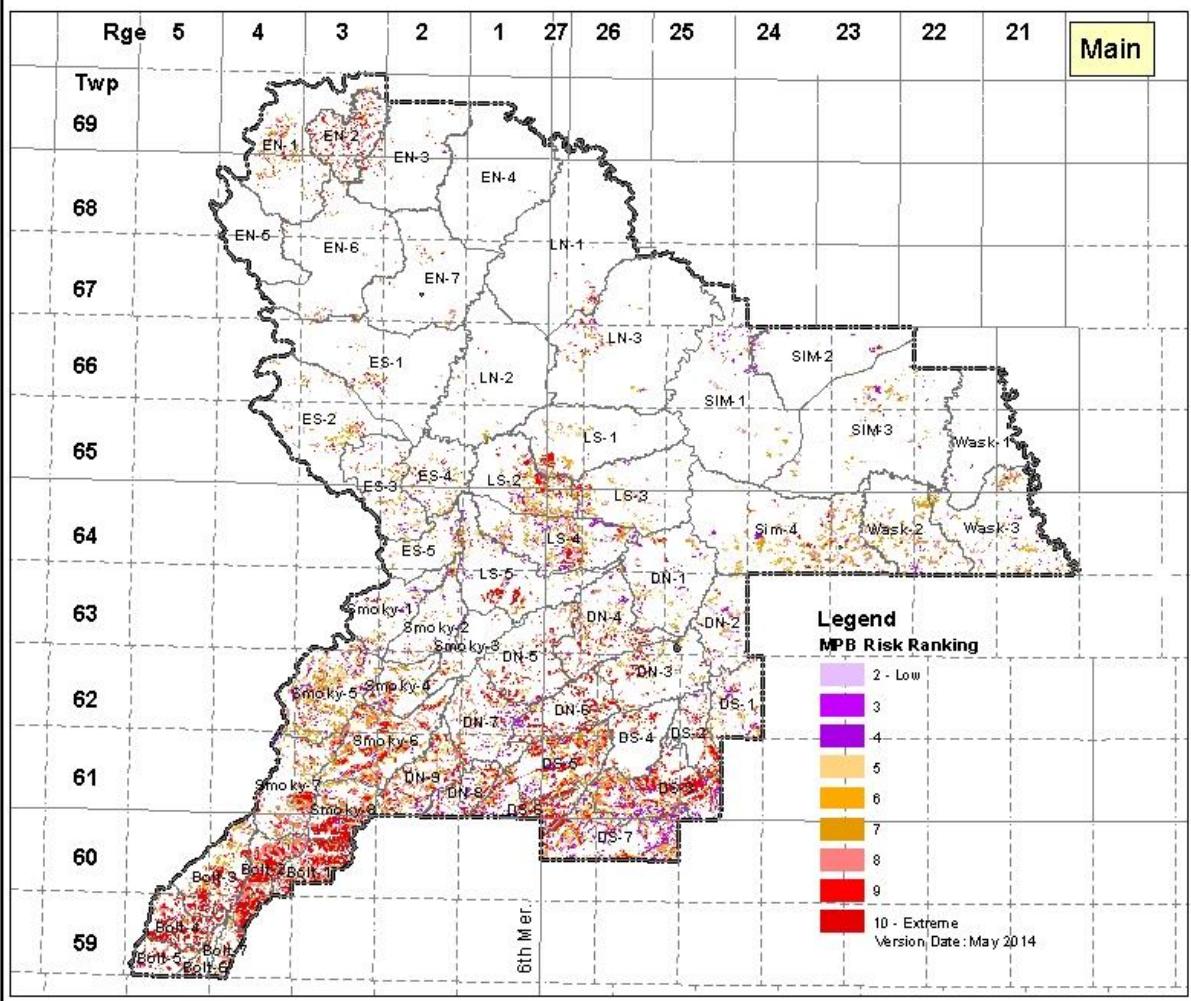


Figure 39 Canfor FMA Area MPB Risk

3.1.4.4 Invasive Exotic Species

Invasive and exotic species can have a large impact on the environment as they are generally opportunistic non-native species that can invade natural areas. These species are usually weeds and plants that were introduced from Europe and Asia (AESRD, 1995-2015). Whereas, native species populations are usually kept in check by native insects, fungi or plant pathogens; invasive species are not. Alberta Parks explains that invasive species can significantly alter native ecosystems by decreasing native biodiversity, impacting plant and animal life, and increasing soil erosion (AESRD, 1995-2015). Invasive species interfere with the ability of native species to persist on the landscape. Invasive and exotic species in Alberta are usually identified as noxious and prohibited noxious weeds as described in the *Alberta Invasive Plant Identification Guide* (Wheatland County, 2013).



Figure 40 Canada Thistle

Photo Source:

<http://www.nps.gov/olym/nature/science/canada-thistle.htm>

Prohibited Noxious Weed: a plant designated in accordance with the regulations as a prohibited noxious weed and includes the plant's seeds. This weed designation can be seen as regulatory support for an "Early Detection, Rapid Response" stage of invasive plant management. Plants in this category are either not currently found in Alberta or are found in few locations such that eradication could be possible. Under the Weed Control Act a person has a responsibility to destroy a prohibited noxious weed.

Noxious Weed: a plant designated in accordance with the regulations as a noxious weed and includes the plant's seeds. This weed designation can be seen as regulatory support for a "containment" stage of invasive plant management. Plants listed in this category are considered too widely distributed to eradicate. A local authority may conduct control programs for these weeds if they feel they may have significant ecological or economic impact on lands within their municipality (p.5).

Often times, noxious and prohibited noxious weeds are transported unknowingly from agriculture, urban, and industrial areas into natural areas by wind, animals, recreationalists, and sometimes machines that have not been properly cleaned.

The Province of Alberta regulates the presence and treatment of noxious weeds for dispositions (roads, camps, and other processing sites) issued under the *Public Lands Act* (GoA, 2014 b.). Section 63 of the *Public Lands Act* (GoA, 2014 b.) states that disposition holders must "cut, keep down, and destroy all noxious weeds and prohibited noxious weeds to which the *Weed Control Act* applies ."The *Public Lands Act*, however does not clearly specify treatment requirements specific to timber dispositions which are issued under the *Forests Act* (GoA, 2014 a.). AESRD's *Directive No. 2001-06 Weed Management in Forestry Operations* (AESRD, 2001) was developed to provide direction under the *Weed Control Act* for dispositions issued under the *Forests Act*.

The geographic location of Canfor's FMA area poses risk to the potential outbreak and spread of noxious and prohibited noxious weeds. The Peace and Puskwaskau parcels as well as the north east side of the Main parcel are adjacent to agriculture lands and grazing dispositions. In addition, the heavy use of the FMA area by other industrial users and recreationalists provides other opportunities for invasive species to be transported into the FMA area.

The Municipal District of Greenview No.16 and Saddle Hills County have weed inspection programs that identify the presence of noxious and prohibited noxious weeds and provide notice to disposition holders to treat the identified areas. Canfor annually inspects its roads and dispositions for noxious and prohibited noxious weeds and also monitors harvested blocks. When noxious or prohibited noxious weeds are identified in the FMA area, they are scheduled for treatment, treated, and monitored the following year for effectiveness and possibly to schedule a retreatment.

Some of the most common noxious and prohibited noxious weeds identified on Canfor's FMA area from inspections can be found in Table 22.

Table 22 Common Noxious Weeds

Common Name	LatinName	Provincial Designation
Canada Thistle	<i>Cirsium arvense</i>	Noxious
Perennial Sow-thistle	<i>Sonchus arvensis</i>	Noxious
Common Tansy	<i>Tanacetum vulgare</i>	Noxious
Scentless Chamomile	<i>Tripleurospermum perforatum</i> syn. <i>T. inodorum</i>	Noxious
Tall Buttercup	<i>Ranunculus acris</i>	Noxious
Oxeye Daisy	<i>Chrysanthemum leucanthemum</i> syn. <i>Leucanthemum vulgare</i>	Noxious
Meadow Hawkweed Complex	<i>Hieracium caespitosum</i> syn. <i>H. pratense</i>	Prohibited Noxious
Orange Hawkweed	<i>Hieracium aurantiacum</i>	Prohibited Noxious
Tansy Ragwort	<i>Jacobaea vulgaris</i>	Prohibited Noxious

3.1.4.5 Forest Succession Trajectories

Forest succession is a natural process from the change of species mix overtime after fire or other natural disturbances. Understanding successional pathways is very complex. Canfor and Geographic Dynamics Corp. completed an analysis of Forest Succession and Evaluation on Canfor's FMA area in November 2001. Species changes vary throughout the landscape and are dependent on the size, level, and intensity of the disturbance, as well as climate, elevation, soil moisture regime, and canopy composition. The mixedwood forest type is the most complex and represents 56% of the forest cover in the FMA area. After a natural disturbance, mixedwood forest cover types will generally regenerate as deciduous dominated; over time conifer will seed in and the forest cover type will shift from deciduous dominated to deciduous with conifer understory and eventually to conifer dominated as the deciduous reaches an



Figure 41 Oxeye Daisy

Photo Source:

http://commons.wikimedia.org/wiki/File:Oxeye_daisy-oliv.jpg

age of breakup. Over the past 35 years of updating the forest cover every ten years, Canfor has seen this trend of successional change.

Although this FMP did not apply successional yield curves, the FMA area was stratified into 17 yield groups. The natural projection of these 17 yield groups can be viewed as successional.

3.1.4.6 Timber Harvesting

The FMA area has been a working forest for more than sixty years. The FMA area has had harvesting occurring since the early fifties. There were a number of bush mills on FMA area (Figure 42). One of the earlier bush sawmills was in the Puskwaskau parcel north of Debolt.

In the past 54 years, 101,476ha has been harvested (Table 23) on the FMA area. Since the Forest Management Agreement was awarded to North Canadian Forest Products Ltd in 1964, as part of Canadian Forest Products Ltd, there has been a series of additions to the FMA through acquiring additional unallocated lands, and trading of Quotas west of the Smoky River for lands east of the Smoky River formally held by Procter and Gamble. Deciduous Quotas were awarded in the mid-1990s and the first deciduous blocks were harvested in 1998.

Table 23 FMA Area Harvest History

Timber Year	Area Harvested (ha)	Timber Year	Area Harvested (ha)
1960	126	1987	3,023
1961	0	1988	2,505
1962	53	1989	2,169
1963	130	1990	3,152
1964	929	1991	2,652
1965	267	1992	3,199
1966	1,222	1993	2,558
1967	940	1994	2,664
1968	886	1995	2,283
1969	1,158	1996	3,031
1970	1,499	1997	2,919
1971	914	1998	2,440
1972	1,218	1999	2,199
1973	1,337	2000	3,171
1974	586	2001	2,396
1975	935	2002	2,870
1976	352	2003	2,678
1977	900	2004	3,717
1978	860	2005	3,164
1979	906	2006	1,491
1980	669	2007	2,188
1981	1,035	2008	2,536
1982	1,403	2009	3,940
1983	1,376	2010	3,130
1984	2,397	2011	3,602
1985	1,460	2012	3,292
1986	2,588	2013	2,364
		Total	93,780

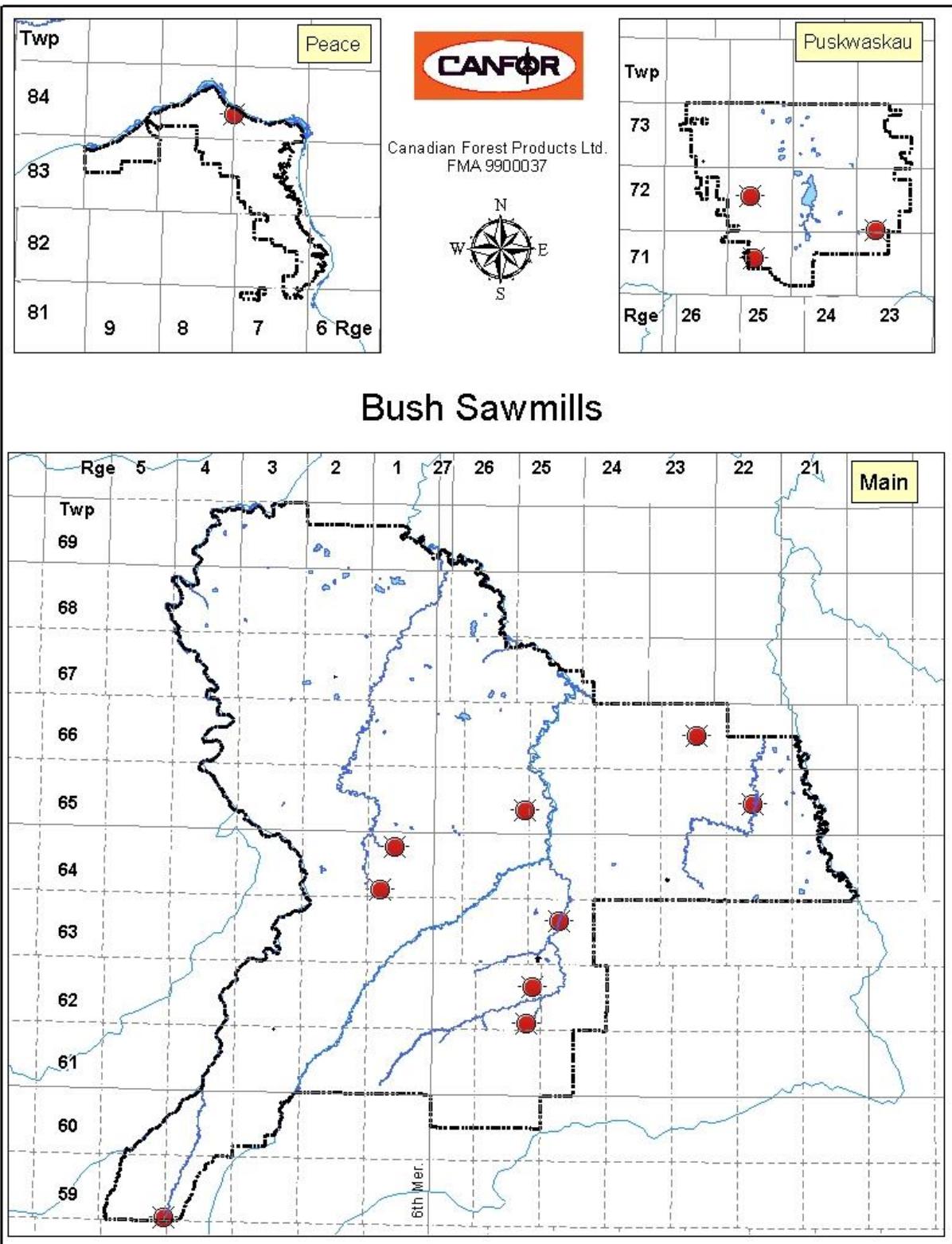


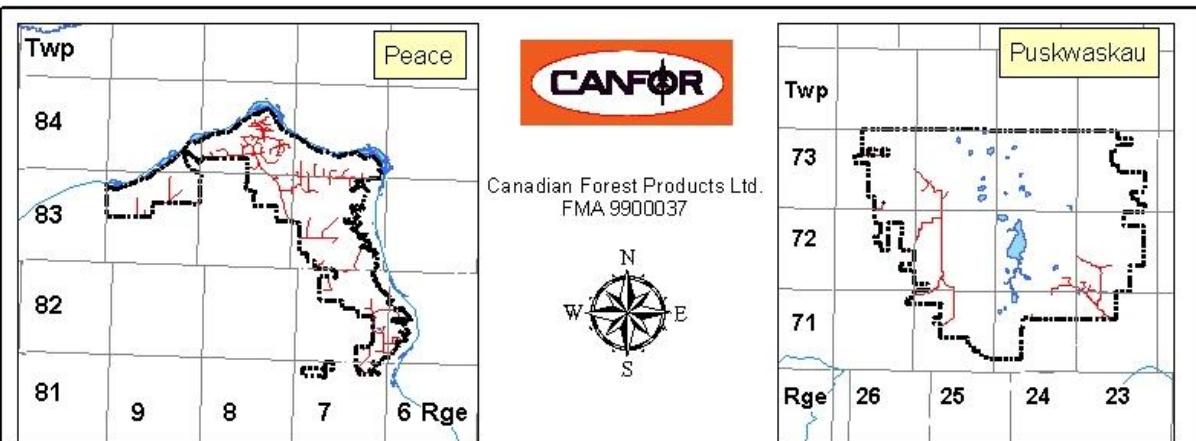
Figure 42 Bush Sawmills

3.1.4.7 Forest Industry Access

Comprised of both company and external stakeholder infrastructure, Canfor's FMA area road network is both well established and secure. In the last decade, the energy sector has contributed significantly to access development on the FMA area. In support of the concept of minimizing the industrial footprint on the landscape, Canfor has attempted to integrate operations and access plans with external stakeholders where opportunities have arisen.

Canfor's main "lease-cutoff" haul road provides access from the Main parcel of the FMA to Canfor's Grande Prairie sawmill. The use of this road is essential in providing a safe route to haul logs to the sawmill while avoiding the use of public roads as much as possible. The lease-cutoff road meets the Forestry Trunk Road near the middle of the Main parcel and continues to the far east side of the FMA area as the "2000" road. Canfor also has roads further south that also connect to the Forestry Trunk Road. The "4000" and "7000" roads provide the main access to the south east end of the FMA area and the "Elevator" road provides access to the very southern tip of the FMA area. In addition to these, Canfor also has several other roads throughout the FMA area that connect to these main arteries.

When operating in the Peace and Puskwaskau parcels of the FMA area, Canfor relies on the use of public roads, highways, and energy sector roads (Figure 43).



Forest Industry Access

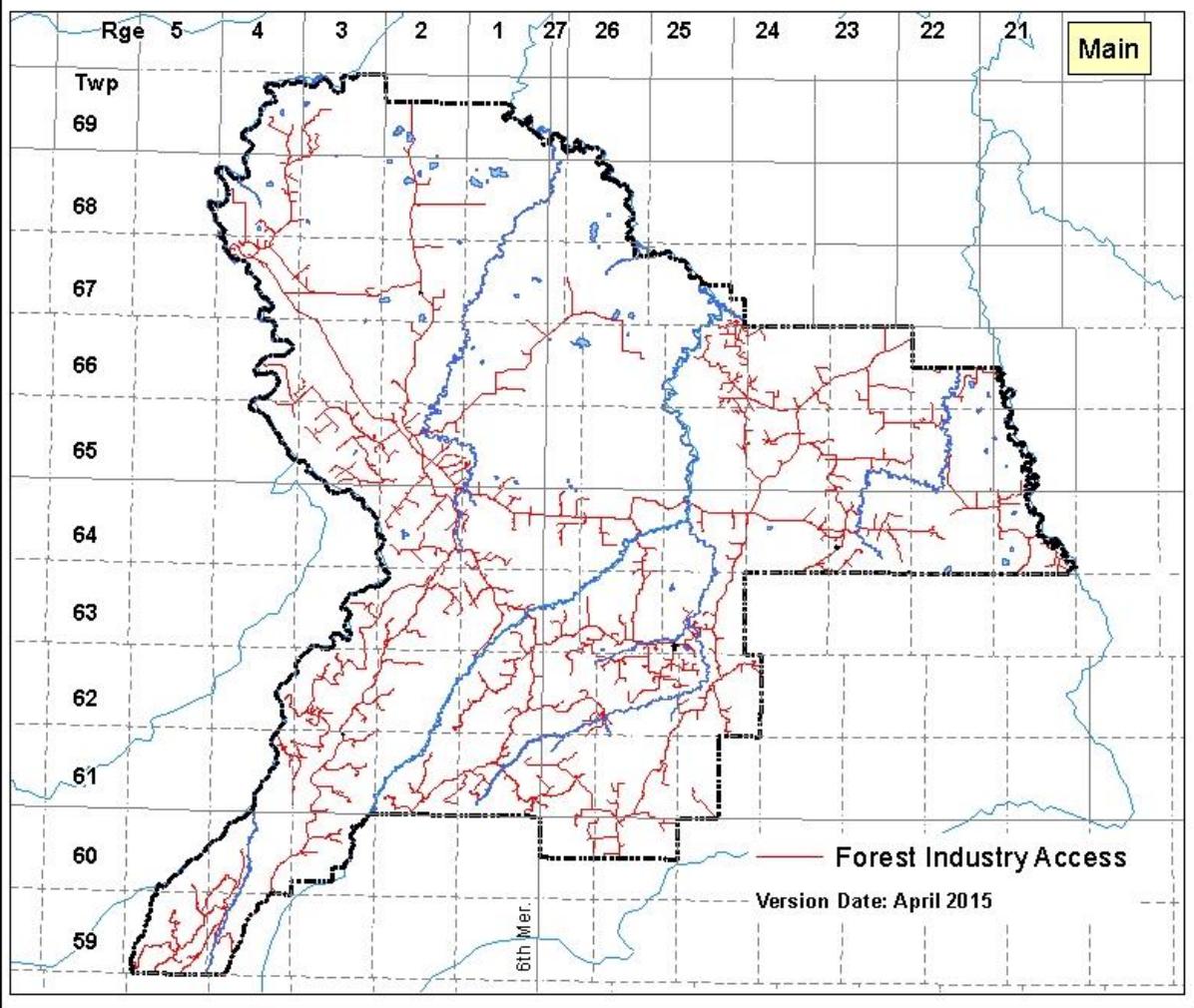


Figure 43 Forest Industry Access

3.1.4.8 Industrial Development

Canfor's FMA area is very active with development from other industries, specifically oil and gas. Developments include access construction (temporary and permanent), wellsites, pipelines, gas plants and facilities, rail lines, and powerlines. Figure 44 depicts some of the major industrial development that exists on the FMA area at this time.

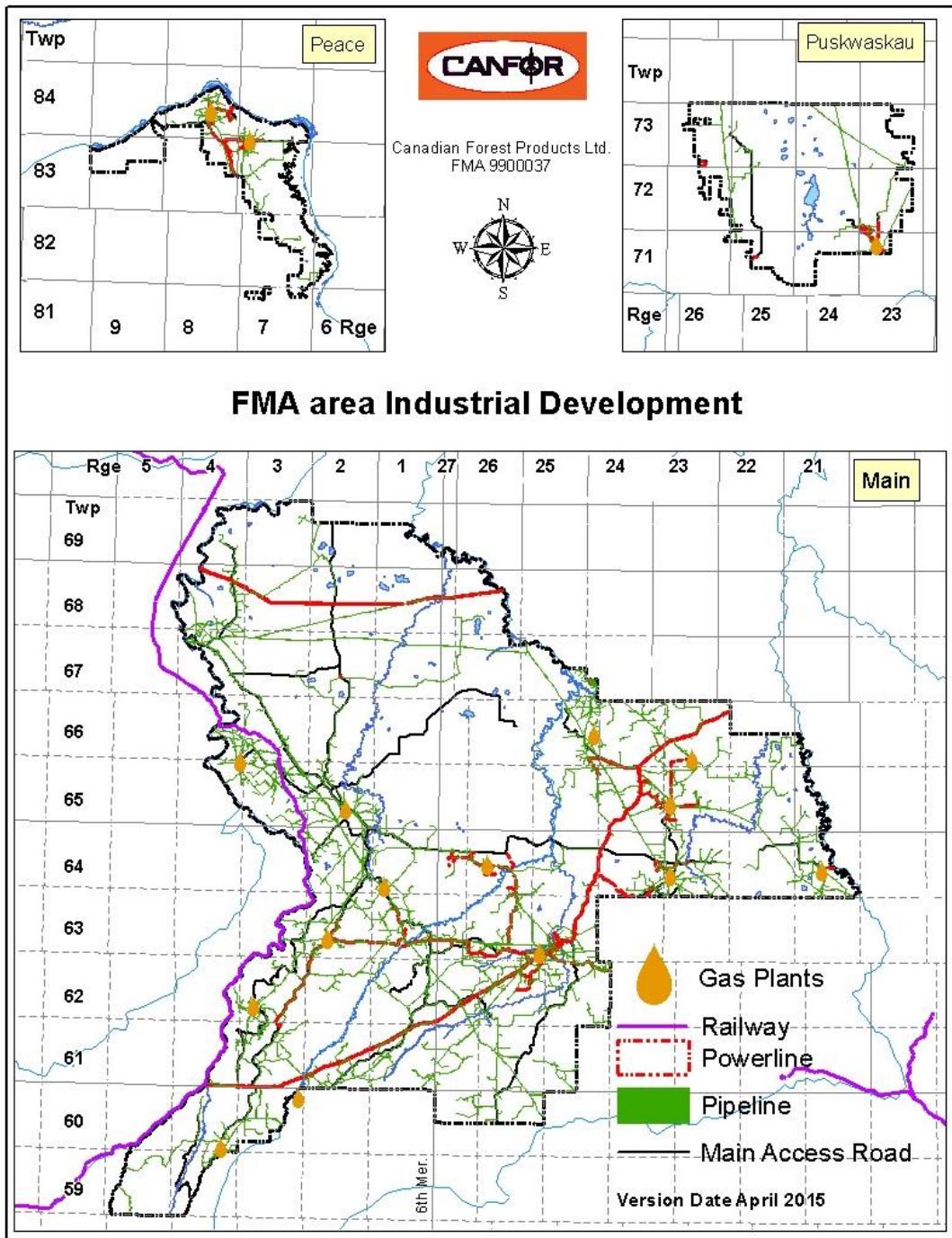


Figure 44 FMA Area Industrial Development



Berland Smoky Regional Access Development Plan

Canfor is an active member of the Foothills Landscape Management Forum (FLMF). FLMF is dedicated to advancing integrated land management in West-Central Alberta. FLMF is a partnership with energy, forest and government sectors. It is a good example of various agencies collaborating on a coordinated approach with the main objective being to minimize the industrial footprint on the landscape. As a result of the collaboration, the Berland Smoky Regional Access Development Access Plan (RAD Plan) was developed (Figure 45) in October 2011. All existing and planned access within the RAD plan area was assessed by all partners to develop a plan that identified all permanent primary and secondary corridor routing required in the area by industry. In addition to this, the group identified routes and strategies for reclamation to reduce the existing permanent industrial road footprint in the RAD Plan area. As a signing partner in FLMF and a partner in the development of the RAD Plan, Canfor is committed to implementing the strategies identified in the RAD Plan.

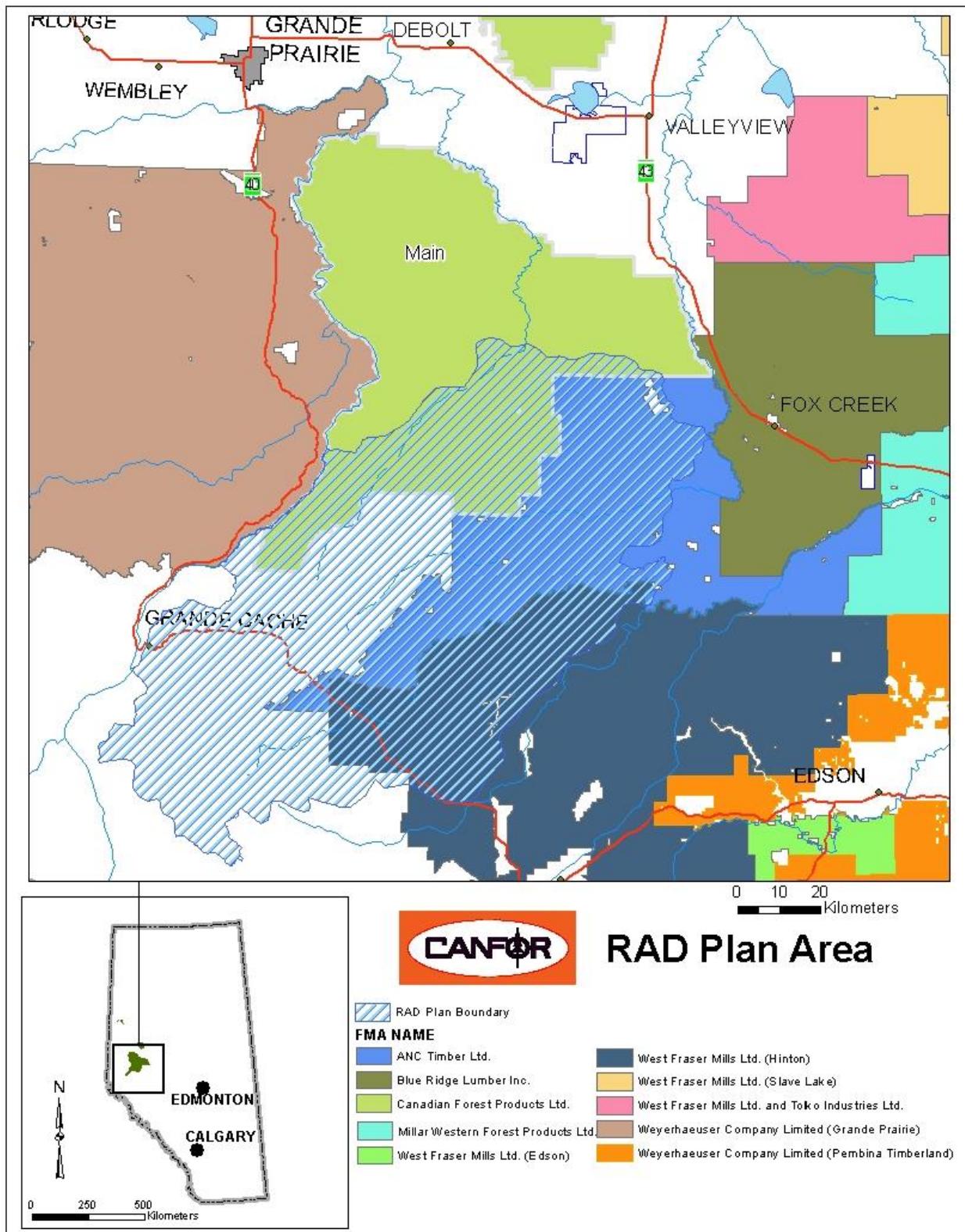


Figure 45 Berland Regional Access Development Plan Area

3.1.4.9 Monitoring Sites

Canfor has many Permanent Sample Plots (PSPs) established throughout the FMA area to monitor the growth and yield of natural fire origin stands as well as managed stands after harvest. The PSP data provides the information to guide sustainable management of the FMA area. The main objective of the PSP program is to provide growth data that can be used to verify and enhance estimates of stand development obtained from other data. The PSP data is used to provide tree- and stand-level information suitable for calibration and use in Growth and Yield models.

Canfor maintains a variety of PSP types within the FMA area including: timber inventory, Foothills Growth and Yield Association (FGYA), Western Boreal Growth and Yield Cooperative (Wesbogy), and progeny sites. All PSPs receive continual maintenance and are re-measured on a regular schedule. All active PSPs have been given Industrial Sample Plot (ISP) notations to ensure that they are not damaged or cleared by other operators on the FMA area.

Canfor has two inventory plot programs. Their initial PSP program which began in 1981 consists of plots mainly in natural fire-origin stands and some managed stands. In 2005, Canfor began a Post-Harvest Regenerated Stand (PHR) program which primarily consists of plots being established in managed stands. Canfor is continually adding PHR plots in newly harvested cutblocks to monitor current silviculture practices.

Table 24 Canfor's Monitoring Sites

Plot Type	# of Plots
Inventory-PSP (natural stands)	688 Plots
Inventory-PHR & PSP (managed stands)	419 Plots
Research (FGYA, Wesbogy, and Progeny)	10 Installations

3.1.5 FIRE

3.1.5.1 Fire History

Prior to fire suppression, fire has played a dominant role in the development and rejuvenation of stands within the Boreal Forest and Foothills Natural Regions. Large fires tend to produce a more homogeneous pattern in structure, species composition and age (i.e. less biodiversity at the landscape level). Large fires have rejuvenating qualities that play a role in ecosystem condition and productivity. Fire control and prevention programs have limited the number and area of fires within the FMA area. Lightning is the prime cause of fires, however with the increase of human activity the percentage of man caused fires has increased.

Where economically feasible, Canfor has developed salvage strategies and salvage logged burned areas. Table 26 identifies how much burned area Canfor has salvage logged in the last ten years. Although unable to salvage log the 2006 fire, Canfor planted 339ha of the burn to return it back to a productive area more quickly.

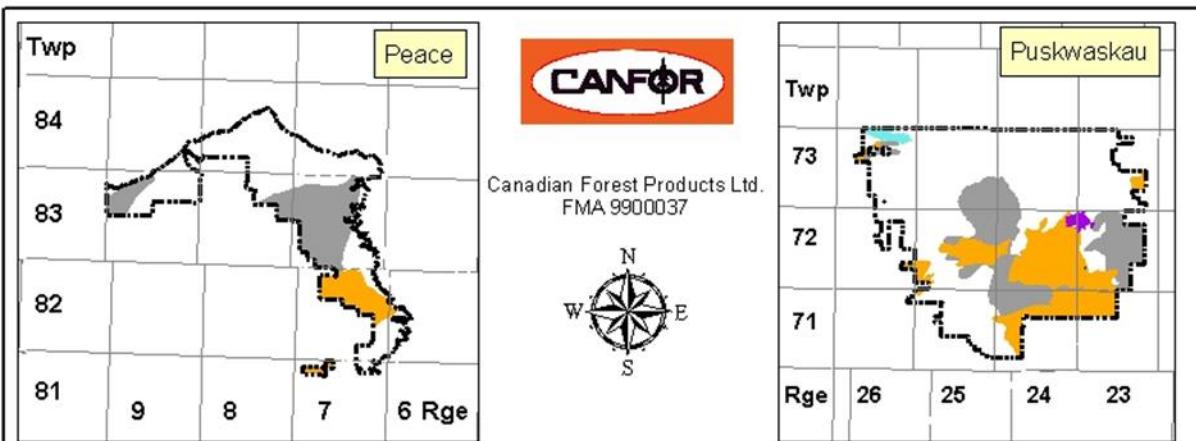
Table 25 Fire History on Canfor's FMA Area

Year	Area Burned (ha)	Year	Area Burned (ha)	Year	Area Burned (ha)
1933	115	1950	5,030	1971	19
1938	56,294	1952	1,402	1998	20
1941	9,388	1953	6,049	1999	0
1943	2,696	1956	711	2002	56
1944	18,790	1957	146	2006	392
1945	7,520	1959	100	2008	55
1946	1,532	1961	3,936	2009	3
1947	4,004	1966	54	2010	7
1948	3,432	1968	7	2013	492
1949	10,510	1970	719	Total	133,477

Data Source: (AESRD, 2014c)

Table 26 Fire Salvage

Year	Area Burned (ha)	Area Salvaged (ha)
2006	391.6	-
2008	55.3	-
2009	2.9	-
2010	6.8	-
2013	492.4	155.47
Total	949	155.47



Fire History

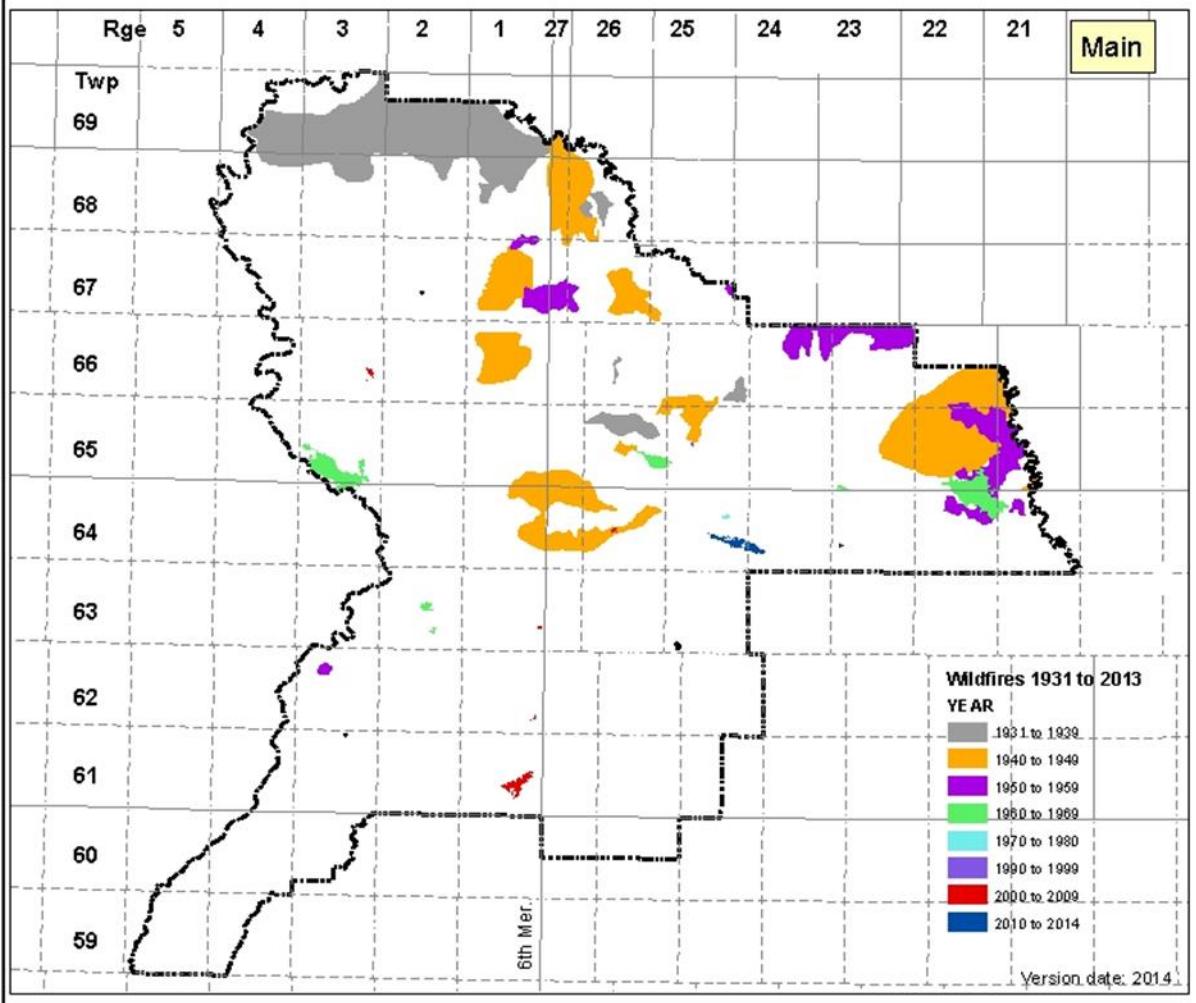


Figure 46 FMA Area Fire History 1931-2013

Source: (AESRD, 2014c)

3.1.5.2 Fire Size

Fires on the FMA area from 1933 through to 1953 averaged 3,000ha in size. From 1954 through to 2013 the average fire size has decreased significantly to 6.8ha (Table 27).

Table 27 Historic FMA Area Fire Size

Year	Total Area Burned (ha)	# of Fires	Average Fire Size (ha)
1933	114.6	1	114.6
1938	56,294.4	14	4,021.0
1941	9,387.6	6	1,564.6
1943	2,695.7	1	2,695.7
1944	18,789.5	4	4,697.4
1945	7,519.8	2	3,759.9
1946	1,531.9	3	510.6
1947	4,004.3	1	4,004.3
1948	3,431.9	1	3,431.9
1949	10,509.5	3	3,503.2
1950	5,029.8	4	1,257.5
1952	1,401.6	1	1,401.6
1953	6,048.5	2	3,024.3
1956	710.9	2	355.5
1957	145.8	1	145.8
1959	100.4	1	100.4
1961	3,936.4	5	787.3
1966	54.1	1	54.1
1968	6.8	1	6.8
1970	718.5	2	359.3
1971	19.4	1	19.4
1998	19.7	1	19.7
1999	0.2	1	0.2
2002	56.2	2	28.1
2006	391.6	2	195.8
2008	55.3	2	27.7
2009	2.9	1	2.9
2010	6.8	4	1.7
2013	492.4	2	246.2
Total	133,476.5	72	1,853.8

3.1.5.3 Fire Season

Alberta's fire season is between March 1st and October 31st. As per Canfor's Fire Control Agreement with the AESRD (GoA, 2013), Canfor submits a Forest Protection Plan (Canfor, 2015a) to AESRD prior to March 1st each year.

3.1.5.4 Forest Protection

Forest protection is primarily the responsibility of AESRD as per subparagraph Section C 25(1) of the FMA agreement, "...the minister agrees to provide and maintain an organization of people and equipment necessary for the protection of the forest from and suppression of the forest fires on the forest management area" (GoA, 2015b). Current forest protection practices fall under provincial pre-suppression and wildfire suppression programs, as well as insect and disease monitoring and control programs. As per Forest Management Agreement Section 28(2), Canfor pays holding and protection annually to the Minister (GoA, 2015b). In accordance with the Fire Control Agreement (GoA, 2013), Canfor will work with AESRD to assist in the delivery of programs outlined. Canfor will also assist AESRD to develop long-term planning to mitigate catastrophic wildfire events (i.e., fire landscape planning and FireSmart planning).

In accordance with regulations, Canfor maintains equipment, such as the fire equipment trailers shown in Figure 48, and trained personnel to assist in fire prevention and control (Figure 47).



Figure 47 Canfor Staff Receiving Fire Training from AESRD



Figure 48 Fire Equipment Trailers

3.1.5.5 Landscape Fire Assessment

Fire is a natural occurrence on the landscape and still occurs despite fire suppression efforts made by the Government of Alberta and industry. Today, about half of all forest fires are caused naturally by lightning and the other half are caused by human activity (AESRD, 2009). Fires can spread extremely rapidly, especially given the strong winds that are common to the Grande Prairie region. These strong winds can easily carry embers several kilometers. Warm dry years, in addition to the presence of dying MPB timber on the landscape can also exacerbate the potential of a momentous fire occurrence. With this being said, forest fires have the potential to significantly impact communities located directly adjacent to forested Crown land.

In order to address and reduce the risk of forest fires from impacting communities, AESRD has developed a program called FireSmart that directs and guides government, home owners, and industry on strategies that can be implemented. "Designing FireSmart by integrating fire, forest, and land management planning activities is the cornerstone of protecting a multitude of values, achieving safety, meeting planning objectives, and ultimately attaining sustainable forest management" (AESRD, 2006a).

As stated in the *Alberta Forest Management Planning Standard-Annex 3* (AESRD, 2006a), Canfor is required to complete a landscape fire assessment (including assessment of the natural disturbance fire regime) that compares the positive ecological impacts of wildfire on the FMA area and the negative

impacts of wildfire through a wildfire threat assessment. This analysis was completed by AESRD and is included in Appendix I (*Canadian Forest Products Limited Grande Prairie FireSmart Management 2015*).

The assessment identified that there are two FireSmart Community Zones which partially overlap Canfor's FMA area:

- Sturgeon Lake-Clarkson Valley FireSmart Community Zone; and
- Little Smoky FireSmart Community Zone.

Figure 49 depicts the current fire behaviour potential for the Canfor FMA area. As shown in the map, the areas overlapping the FireSmart Community Zones show relatively low to moderate fire behaviour potentials with small pockets of stands labeled as very high fire behaviour potential. It also identifies that there are a few larger areas of the FMA, such as south of the Deep Valley, that have very high fire behaviour potential. Canfor has developed objectives and targets to help reduce the risk of wildfire threat in the FMA area and the FireSmart Community Zones in Section 9.1.1.3.

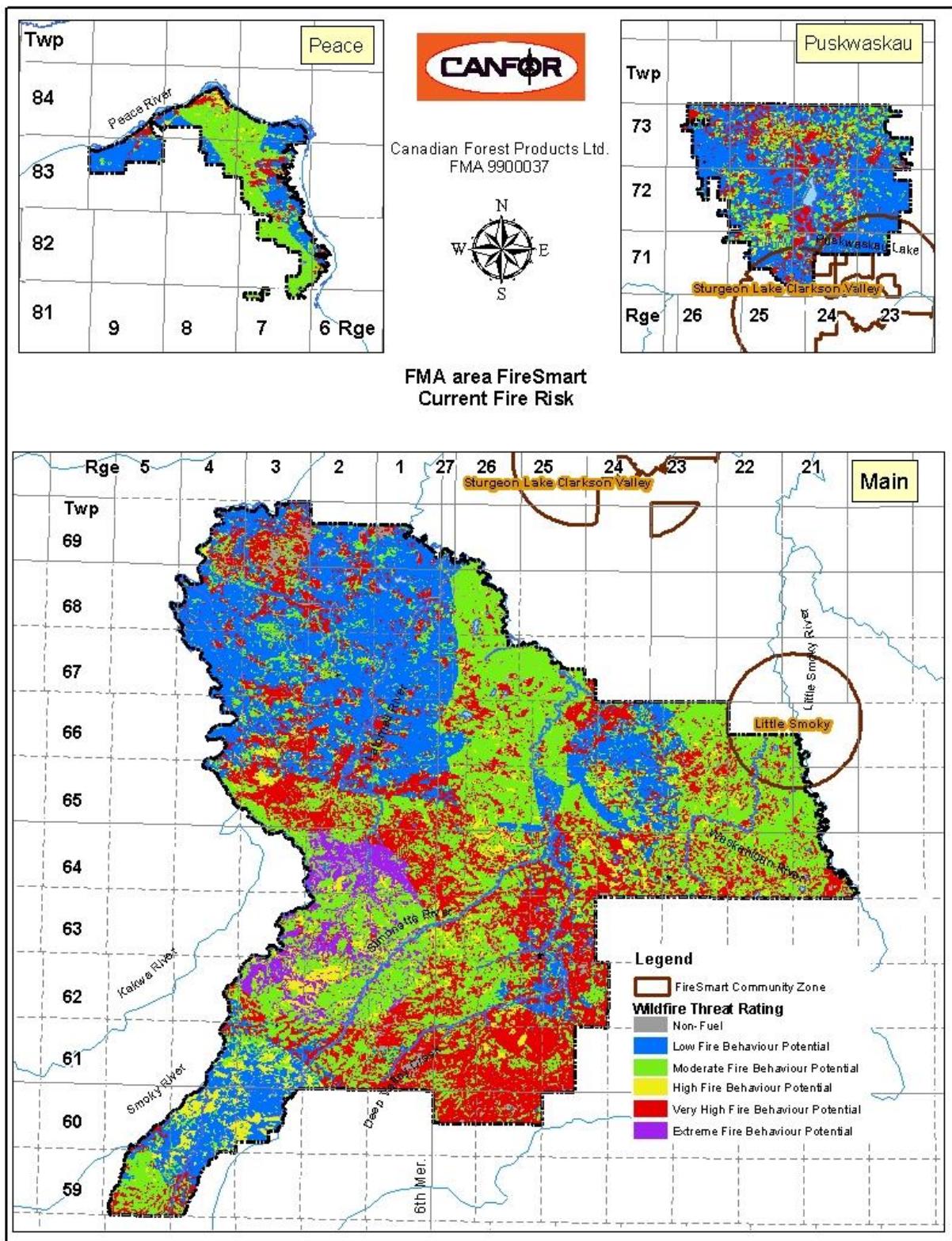


Figure 49 Canfor FMA-Fire Behaviour Potential

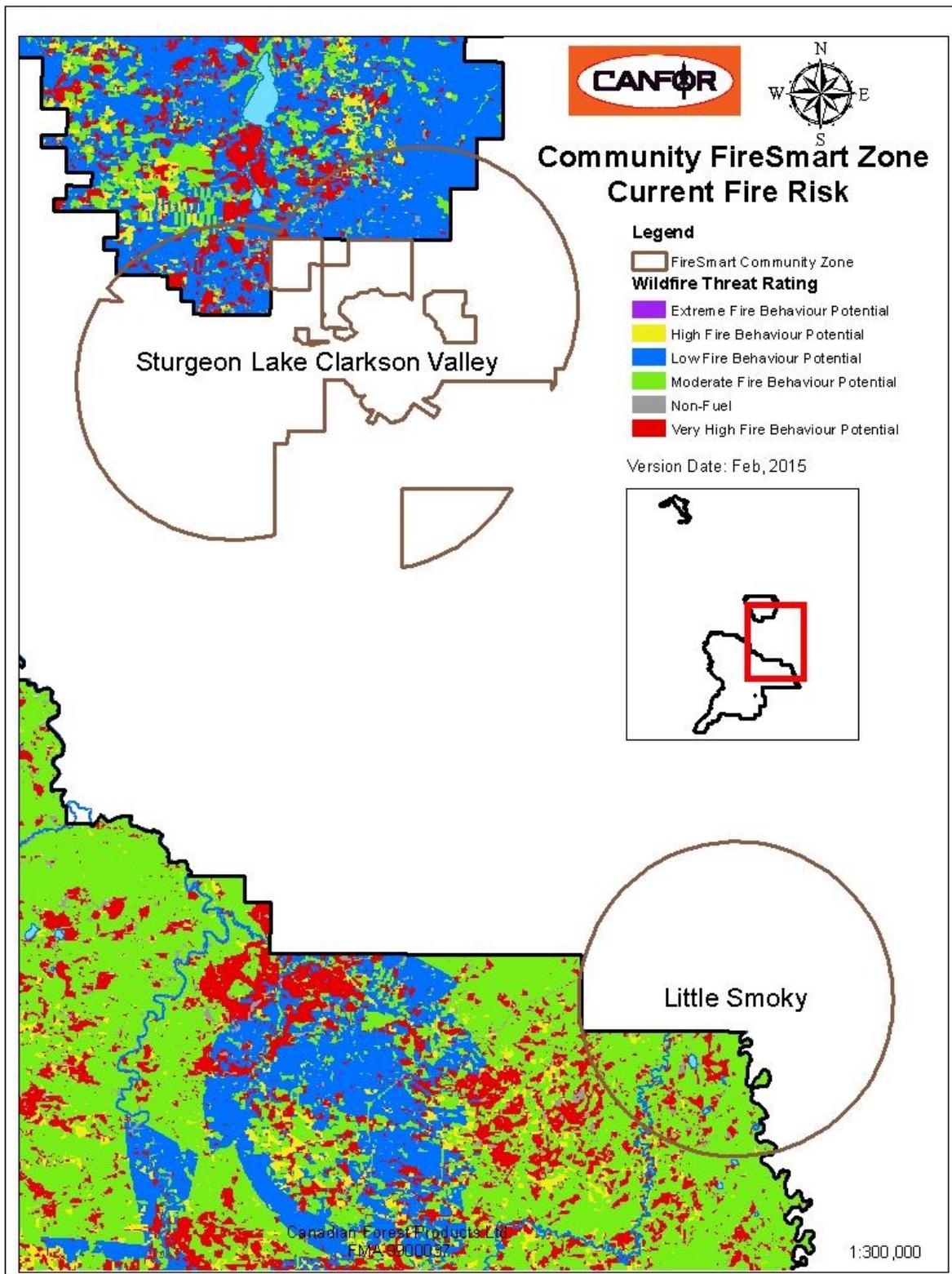


Figure 50 FireSmart Community Zones-Fire Behaviour Potential

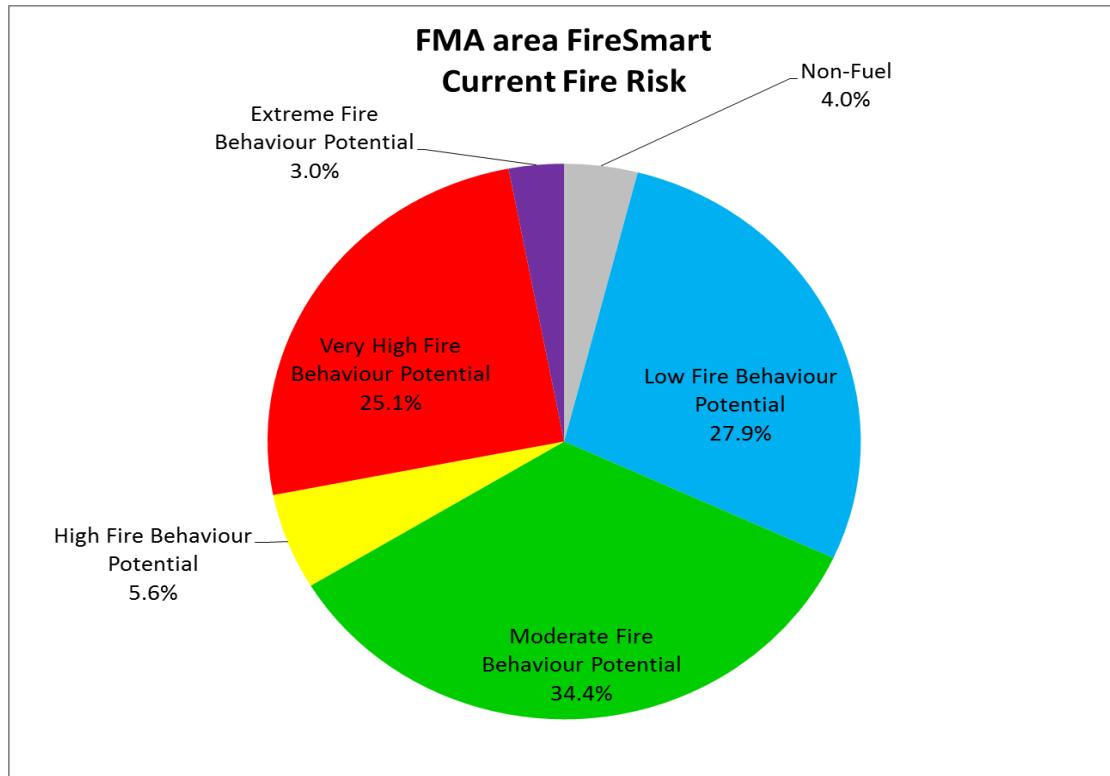


Figure 51 Canfor FMA Area Current Fire Behaviour Potential

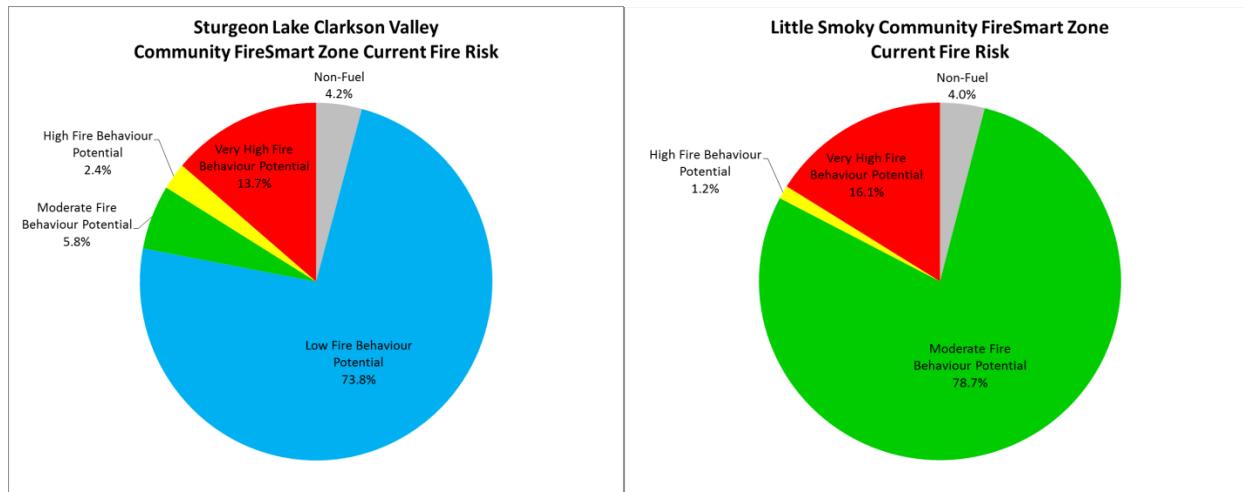


Figure 52 Community Zones Current Fire Behaviour Potential

3.1.6 LAND USES

3.1.6.1 Timber

All of the timber resources on the FMA area have been allocated through the Forest Management Agreement (FMA), Deciduous Timber Allocations (DTAs), Community Timber Permits (CTPs) and short term timber dispositions for local use. When there is a land withdrawal from the FMA area by another industry, that requires the clearing of merchantable timber, Canfor has the rights to purchase the

conifer and Norbord and Tolko have the rights to purchase the deciduous salvage timber. The objective is to salvage all economically feasible merchantable timber from the FMA area.

3.1.6.2 Registered Fur Management Areas

Trapping of furbearing animals has been a traditional pursuit in Western Canada since the mid-1600s. It has helped open the country to exploration and started the commerce that eventually built a nation. Trapping continues in Alberta today.

Trapping is a viable use of a naturally renewable resource. Each trapper is responsible for managing the furbearers on his or her trapping area. Trappers are concerned with the well-being of the resource and ensure the animals they harvest can easily be replaced by the naturally reproducing wild populations. Without concerned trappers in the field constantly assessing furbearer populations, the status of many of these species of Alberta wildlife may not be known. A Registered Fur Management Area (RFMA), commonly known as a trapline, is a parcel of public land allocated to the holder of a Registered Fur Management License by AESRD. These registered trappers may form partnerships with other trappers to trap their RFMAs.



Figure 53 Trappers Cabin on Canfor FMA

There are 58 RFMAs in Canfor's FMA area (Figure 54). Canfor developed the *Trappers Notification Program* (Canfor, 2012a) to ensure all trappers affected by Canfor's Annual Operating Plan (AOP) are notified and made aware of all activities planned within their RFMA. The Company sends a registered letter annually to notify affected trappers of planned harvesting and silviculture activities. Any concerns are addressed by company supervisors and recorded in Canfor's Creating Opportunities for Public Involvement (COPI) database.

The Alberta Trappers Association represents trappers in the Province. Their representative participates in the development process for the Forest Management Plan (FMP) and Sustainable Forest Management Plan (SFMP) by providing input as an active member of the Forest Management Advisory Committee.

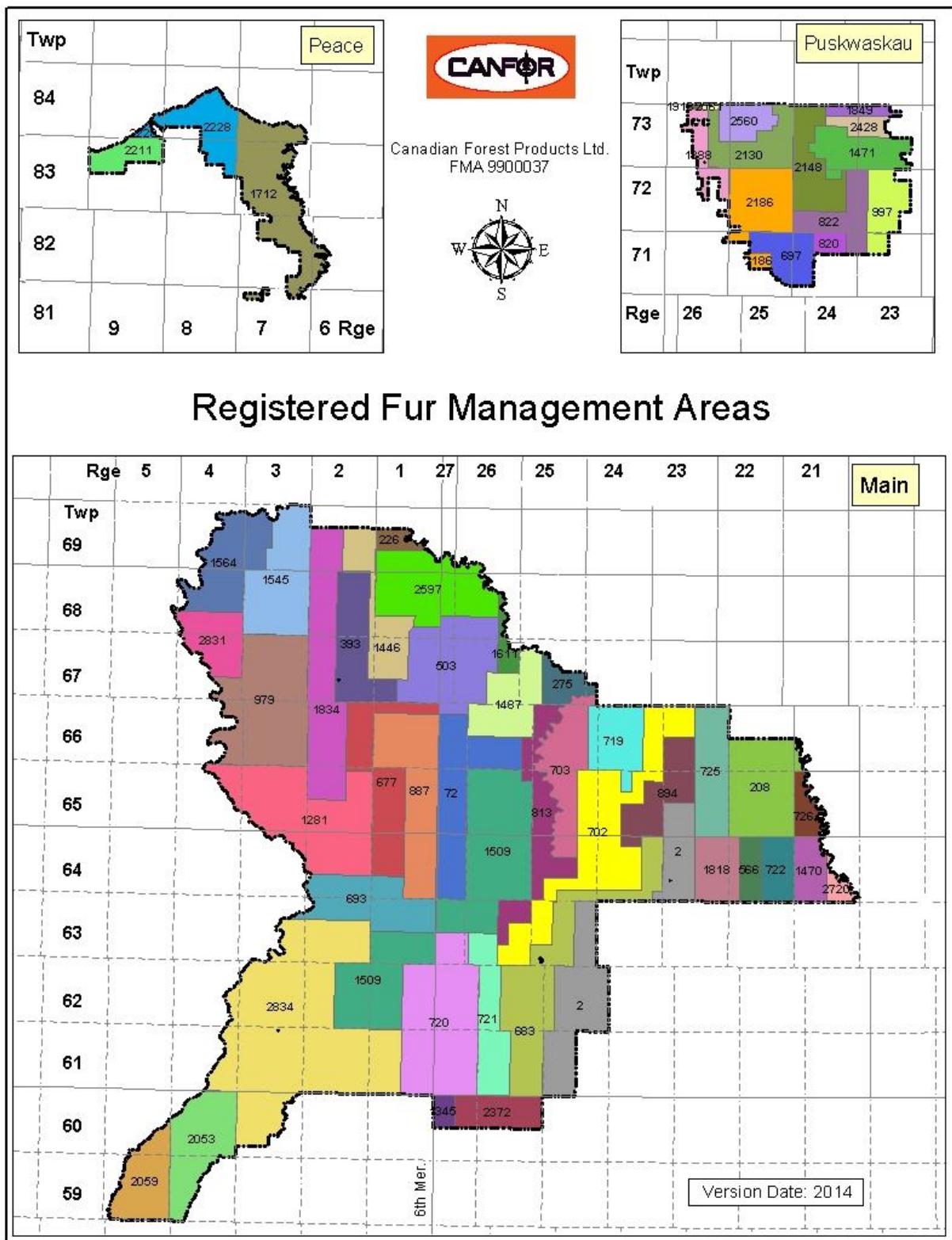


Figure 54 Registered Fur Management Areas



3.1.6.3 Grazing

According to the *Public Lands Act*, *Public Lands Administration Regulation* (GoA, 2011a), a grazing disposition is a grazing lease, a grazing license, a grazing permit, or a head tax grazing permit. There are 5 Forest Grazing Licenses (FGL) within the FMA area (Figure 55).

In accordance with subparagraph 8(1)(d) of FMA, the Minister has:

...the right to authorize trapping and, after consultation with the Company, to authorize domestic stock grazing provided that the domestic stock grazing will not damage regeneration of managed species to the point where growth performance and overall stocking are reduced below the reforestation standards provided for in or agreed to pursuant to the Timber Management Regulation and provided that the Company's right to establish, grow, harvest, and remove timber is not significantly impaired (GoA, 2015b).

If there are any operations planned in a grazing license, meetings are held with grazing disposition holders to discuss the harvesting plans and will adhere to the Government of Alberta's *Grazing and Timber Integration Manual* (GoA, 2011).

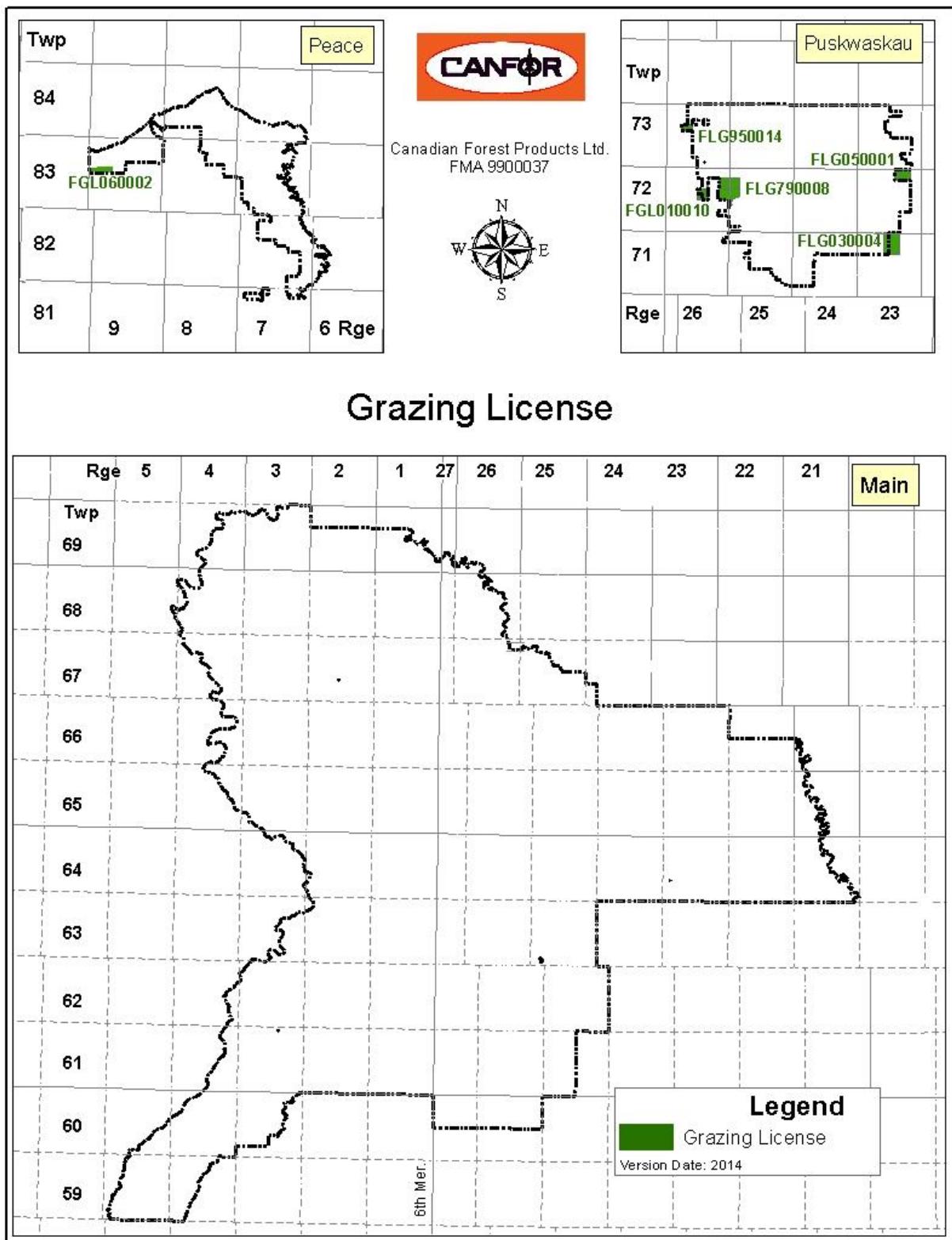


Figure 55 Grazing Licenses

3.1.6.4 Oil and Gas Industry

In addition to forest resource companies (such as Canfor) holding tenure within the FMA area, substantial oil and gas commitments and development are also present. The cumulative effects of both industries significantly impact the footprint on the landscape and future forest state. Oil and gas companies are required to consult with and obtain consent from Canfor, the FMA holder, prior to submitting applications to withdraw dispositions from Canfor's FMA area.

Dispositions can be for well sites, pipelines, facilities and camp sites. Upon receipt of withdrawal applications from oil and gas and prior to consenting, Canfor reviews each application to ensure it minimizes industrial impacts on the land and resources and integrates with Canfor's future plans. Upon receiving Canfor's consent, the oil and gas company is granted a disposition by the Alberta Energy Regulator and must then pay a Timber Damage Assessment (TDA) to Canfor.

The amount payable under the TDA is comprised of three criteria: timber value, loss of annual allowable cut (maximum volume of timber that the FMA holder can harvest per year) and cost of future reforestation. These values are calculated annually and agreed to by the Alberta Forest Products Association on behalf of the forest industry and the Canadian Association of Petroleum Producers on behalf of the oil and gas industry. The construction of dispositions within Canfor's FMA area results in cutting of timber. Canfor aims to salvage all timber from oil and gas dispositions and pays the oil and gas company for timber that is salvaged and delivered to its Grande Prairie sawmill.

A summary of the area by disposition type removed from the FMA area over the last five years can be found in Table 32. Canfor is also tracking annually how much area that it is returning to productivity through the planting of oil and gas dispositions such as well sites, gravel pits, leases, and roads.

3.1.6.5 Recreation

Canfor maintains 4 recreation areas within the FMA area and financially supports 2 recreation areas outside the FMA area (Figure 57):

- MacLeod Flats (formerly Smoky Flats);
- Economy Lake;
- Frying Pan Creek;
- Westview; and
- Swan Lake (outside the FMA area)
- Stony Lake (outside the FMA area)

Canfor published a brochure titled *Canfor Public Recreation Areas* (Canfor, 1998) that is available through the Grande Prairie Tourism Association, Muskoseepi Park and Canfor's administration office. A description of each recreation area is contained within the brochure.

A typical site includes camping stalls, picnic tables, firewood, garbage receptacles and pit toilets. MacLeod Flats and Economy Lake also have well water, which must be boiled before using. All camping and firewood are currently provided free of charge.

Canfor retains a campground attendant for sites within the FMA area to provide maintenance and an adequate supply of wood. A local resident has been hired to maintain the Swan Lake Recreation Area.

Alberta Conservation Association, Natural Resource Services and Canfor developed Swan Lake Recreation Area as a year-round sports fishery. Swan Lake, located approximately 25km southwest of Valleyview, is aerated each winter to ensure oxygen levels are adequate to maintain the stocked rainbow trout. The site contains a small boat launch and day-use facility such as a cookhouse and picnic area. The Valleyview Fish and Game Association and Alberta Conservation Association (formerly the Buck for Wildlife Program) have also secured lands around the lake for several habitat diversification projects that enhance forage and browse for ungulates.



Public Recreation Areas



Figure 56 Canfor Public Recreation Areas

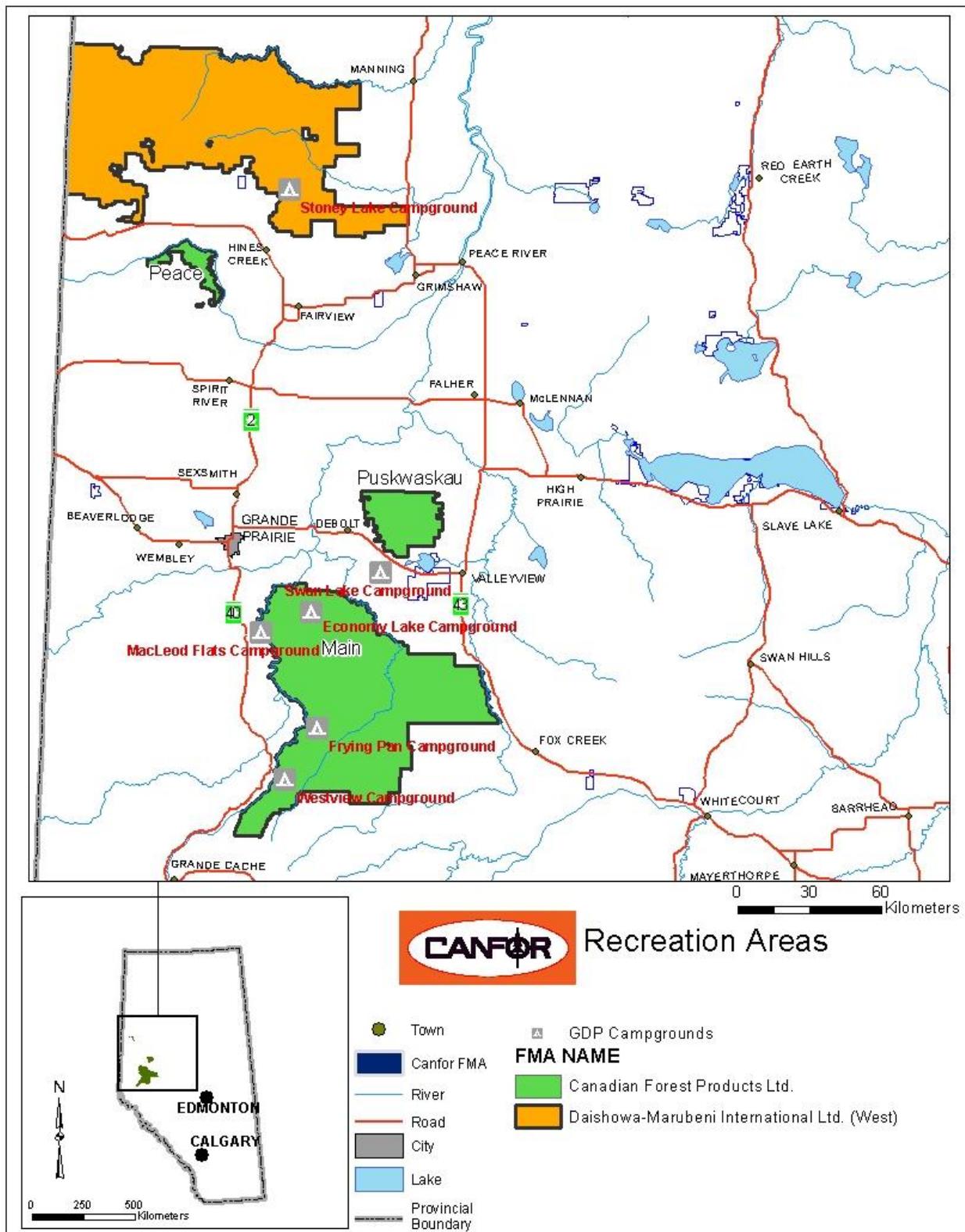


Figure 57 Recreation Areas

3.1.6.6 Tourism and Recreational Uses

A majority of Canfor's FMA area falls within the Grande Prairie Regional Tourism Destination Region. In addition to the use of the recreation areas in which Canfor maintains, there are a variety of other recreational uses within the FMA area. Hunting, fishing, canoeing, river boating, trail riding, ATV riding, snowmobiling, berry picking, etc., are also very popular recreational activities.

From 2003-2005, Canfor completed a recreational assessment of several of the campsites in which it maintained. The purpose of the assessment was to define the recreational use in the study area and obtain public input regarding adequacy of the facilities (Engel, 2006). Table 28 indicates the most popular activities undertaken at each of the recreational areas.

Table 28 Recreational Use of Canfor's Campsites

Type of Use	Recreational Area Use (%)					
	Macleod Flats	Economy Lake	Frying Pan Creek	Westview	Swan Lake	Stony Lake
Hunting	2.8	8.6	66.7	0	0.8	0
Fishing	9.7	0	0	0	74.8	39.4
Nature/Camping	34.5	14.3	16.7	100	6.3	35.2
Picnic	9	5.7	0	0	9.4	5.6
ATV	21.4	40	0	0	0.8	2.8
Photography	0	0	0	0	2.4	0
Horses	0	0	0	0	0	0
Boat/Canoe	13.1	28.6	0	0	5.5	12.7
Hiking	6.9	2.9	16.7	0	0	0
Work	0	0	0	0	0	1.4
Other	2.8	0	0	0	0	2.8
Total %	100	100	100	100	100	100

Canfor's FMA area encompasses several major river systems such as the Smoky River, Little Smoky River, Simonette River, and Wapiti River that attract tourists and locals for a variety of uses.

Canfor's Main parcel of FMA area is also divided by the Forestry Trunk Road (Secondary Highway 743), which runs south from Highway 43 at Goodwin Corner to Muskeg Corner on Highway 40. This gravel road is used by both the forestry and oil and gas industries in the region, but is also popular for locals and tourists that wish to hunt, fish, camp, and explore more secluded areas.

The historic Edson Trail also runs along the east side of Canfor's FMA area. This trail was used by settlers to travel from Edson to Grande Prairie between 1911 and 1916. There is a historic Edson Trail log cabin located near the Waskahigan River in the Little Smoky area. Several books have been written about the historic Edson Trail (Grande Prairie Tourism Association, 2014).

3.1.6.7 Outfitting

Outfitters operate in all portions of the FMA area. All outfitters in Alberta are managed through the Alberta Professional Outfitters Society (APOS). Outfitters operate within Wildlife Management Units (WMUs) established by AESRD (Figure 61). APOS has a representative on Canfor's Forest Management Advisory Committee, which provides input into Canfor's SFMP and FMP.

3.1.6.8 Cultural Resources

Canfor maintains cultural engagement with First Nations communities following the Government of Alberta's *Policy on Consultation with First Nations on Land and Resource Management, 2013* document. Alberta Culture is the regulatory authority for traditional use sites that are considered historic resources under the *Historical Resources Act*. Traditional use sites include but are not limited to burial sites/burial grounds, historical and ceremonial/sacred sites. Some of these sites are occasionally encountered during Canfor operations.

These traditional use sites are identified on a limited basis on publicly accessible databases, and in greater detail on restricted databases that are accessible by Canfor's historical management consultant, Western Heritage. The databases identify lands that contain or are believed to contain traditional use sites of a historic resource nature. Canfor's proposed harvest developments are assessed against the most current version of the database and obtain HRA clearance on lands that contain an HRV 4c⁶ designation in the database. If Canfor activities are predicted to potentially impact traditional use sites, the province may direct Canfor, or its consultant, to undertake consultation with First Nations to address these impacts.

3.1.6.9 Historical Resources

Archaeology is the study of human history through the examination and interpretation of the physical evidence left behind by people in the past. This evidence can range from recent built structures such as cabins to imprints of past cultures left as remnants in the ground, including artifacts, features and residues that last for many thousands of years. In Alberta there is evidence that people have resided in the Province (and in the Grande Prairie area) for at least 10,000 years. These historical remnants, generally called "historical resources"⁷, are legally protected in the province by the *Alberta Historical Resources Act*, renamed from an earlier Act proclaimed in 1973. Under the Act, all historical resources are considered non-renewable and the property of the Crown. The basic principle of archaeological resource management in Alberta is one of maximizing resource protection and preservation in conjunction with research programs which enhance the knowledge of archaeology. Only qualified individuals are permitted to search for and assess historical resources. This is done through an archaeological permit system administered by Alberta Culture and Tourism.

⁶ HRV 4c: "Alberta Culture is the regulatory authority for traditional use sites that are considered historic resources under the Historical Resources Act (HRA). These traditional use sites are identified as an Historic Resource Value (HRV) 4c on the Listing of Historic Resources. The Listing identifies lands that contain or are believed to contain historic resources, including archaeological and paleontological sites, traditional use sites of an historic resource nature, and historic structures. Traditional use sites include but are not limited to burial sites/burial grounds, historical and ceremonial/sacred sites. Proponents must obtain HRA clearance on lands that contain an HRV 4c" (GoA, 2015a).

⁷ Historical Resources: "Any work of nature or man that is primarily of value for its paleontological, archeological, prehistoric, historic, cultural, natural, scientific, or aesthetic interest, including, but not limited to, the structure or object and its surrounding site" (AESRD, 2006a).

In Alberta, all public and private land owners and developers are responsible for the preservation of historical resources. If historical resources cannot be protected it is the responsibility of the developer or land owner to ensure that all information about the resources is secured prior to their damage or destruction, following the guidelines specified within the *Historical Resources Act* or supplementary documents associated with it. The historical resources management strategy adopted by Canfor was designed and is currently implemented by Western Heritage for Canfor's annual operations. The strategy is guided by a commitment towards compliance with the Act and the conditions imposed by it.

Canfor's historical resources ("heritage") management process integrates provincial historical resources policy and procedure into existing long term management processes for Canfor's FMA area. The successful implementation of the heritage management strategy requires the creation of an Annual Operating Plan (AOP) heritage submission that screens proposed harvest blocks and associated access roads to be developed during the forthcoming season. The screening process determines the annual in-field heritage assessment requirements for forest harvest developments in the AOP. The Pre-Impact fieldwork is conducted prior to winter and is confined to forest harvest developments where subsurface impacts are expected to be moderate to high (i.e., access road construction, silviculture, etc.). The completion by Canfor of both fieldwork and reporting fulfills the annual compliance requirements of the *Alberta Historical Resources Act* and the Archaeological Permit issued for it.

As described above, the objectives of Canfor's heritage management program are the protection and preservation of the archaeological resource base within its FMA area and the mitigation of impacts to that base through archaeological study. The primary objective is avoidance of known archaeological and historical sites during the operational planning stage using GIS-based correlation of various archaeological and historic site location data sets maintained by the Archaeological Survey of Alberta, or documented historically by Canfor and Western Heritage. The second method of reducing impacts to the archaeological resource base involves locating previously unrecorded significant sites and modifying development plans to avoid them. This method uses a digital heritage potential model. This

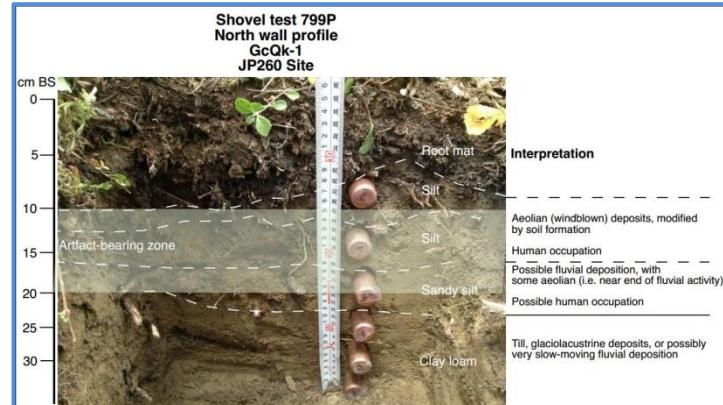


Figure 58 Stratigraphic Profile Description of Newly Discovered Site



Figure 59 Historical Artifacts—Stone Flakes Found on New Archaeological Site

model identifies potential archaeologically sensitive locations in combination with other terrain data using a specially devised impact classification system to evaluate the impact planned developments may have on identified high potential locations. In those locations, harvest practices that will minimize ground impacts are encouraged. Where the probability of impact remains high, an archaeological field reconnaissance is conducted to assess the potential presence of historical resources within the proposed development zone, locate any heritage sites which may be present, assess their significance, and when significant, flag the locations for avoidance.

Even though these methods are designed to prevent predictable impacts to known sites and identify many previously unrecorded sites so that they may be avoided, not all sites will be found and avoided. Therefore, the second objective of Canfor's heritage management program is mitigation for these unpreventable impacts. This is done through occasional post-development impact inspection and, very rarely, through mitigative excavation to collect archaeological information that would be lost through development.

In summary, Canfor's heritage management program avoids previously identified archaeological and historical sites, avoids a proportion of the sites which would otherwise be impacted, and recovers archaeological and historical data to mitigate the unavoidable impacts to previously unknown sites.

As an example of the process, in 2014, at the request of Canfor, Western Heritage conducted a Historical Resources Overview Assessment on 581 proposed Canfor AOP developments (144 harvest blocks and 437 access roads) within 23 operating areas. Sixty-three (10.8%) of the 581 screened developments were identified as exhibiting heritage resources potential and were recommended for Pre- and Post-Impact field assessments to be conducted prior to and after the winter 2014/2015. Four developments were deleted from the AOP. Fifty-five of the 63 developments were surveyed while the remaining four developments were proposed to be completed in the 2015 field season. The remaining development areas associated with the Canfor 2014/2015 AOP were not recommended for fieldwork.

The infield assessment of the proposed developments resulted in the discovery of seven new archaeological sites. The majority represented small pre-contact, subsurface lithic remains of undetermined character, while a large pre-contact, subsurface campsite, measuring approximately 110 m by 80 m was identified. Many of these sites were the first or second ones found in their region. Detailed stratigraphic analysis (Figure 56) of the newly discovered sites (but without formal laboratory dates being secured) indicated that several sites are probably quite old (i.e. occupied more than 5,000 - 7,000 years ago) and some may be much younger in age (occupied within the last 2,000 years). Additionally, several sites appear to have been revisited one or a number of times, possibly over



Figure 60 Remnants of Historical Cabin Found on Canfor's FMA Area

thousands of years. One site was represented by a potentially historic dwelling consisting of a cabin remnant and two depression features. Another site produced a recognizable dart point, suggesting that it was occupied between 50 B.C to 750 A.D. All sites were successfully avoided by Canfor harvest developments and have been registered with the Government of Alberta as protected historical resources.

3.1.6.10 Visual Resources

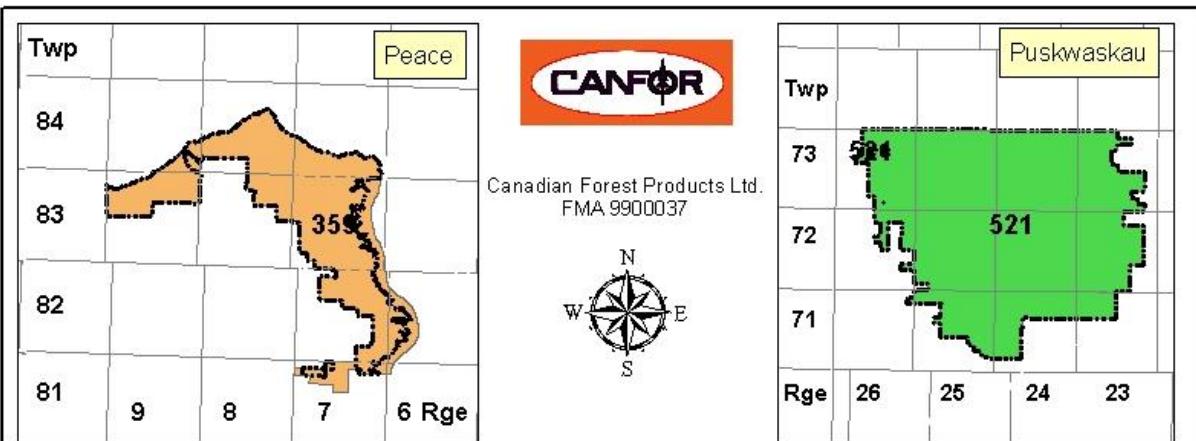
The main travel corridor through the Main parcel of the FMA area is Secondary Highway 734, commonly known as the Forestry Trunk Road. Due to Canfor's priority being the implementation of an effective Mountain Pine Beetle Strategy, a visual quality assessment has not been conducted along this corridor in recent years. Although MPB will continue to be a priority for the next ten years, Canfor has recognized that a visual quality assessment is needed in order to identify areas and viewpoints of high value along the Forestry Trunk Road corridor. This assessment will help direct Canfor where to apply visual resource management strategies operationally within high value areas.

3.1.6.11 Fish and Wildlife Resources

The FMA area is home to a wide variety of wildlife that are managed and regulated by the Crown. Canfor's FMA area is very popular for hunting and fishing enthusiasts and the roads located on Canfor's FMA provide access to these resources.

Many aborigines, locals, and people from across the province travel to the area to hunt for big game such as Black Bear, Moose, Elk, Mule Deer, White-tailed Deer, Cougars, and Wolves. Game birds such as Grouse and waterfowl are also popular. Hunting tags and draws are allocated as per the Wildlife Management Units (WMUs) established by AESRD (Figure 61).

Although the lakes found on Canfor's FMA area are fairly small and shallow and do not generally support game fishing, the abundance of rivers and creeks on the FMA area do provide excellent sources for angling. Arctic Grayling, Bull Trout, Charr, Rocky Mountain Whitefish, Northern Pike and Walleye are the most common species caught while fishing the rivers and creeks on Canfor's FMA. The illegal harvesting of Bull Trout and Arctic Grayling as well as habitat loss, and increased pressures from human activities is resulting in decreasing populations.



Wildlife Management Unit

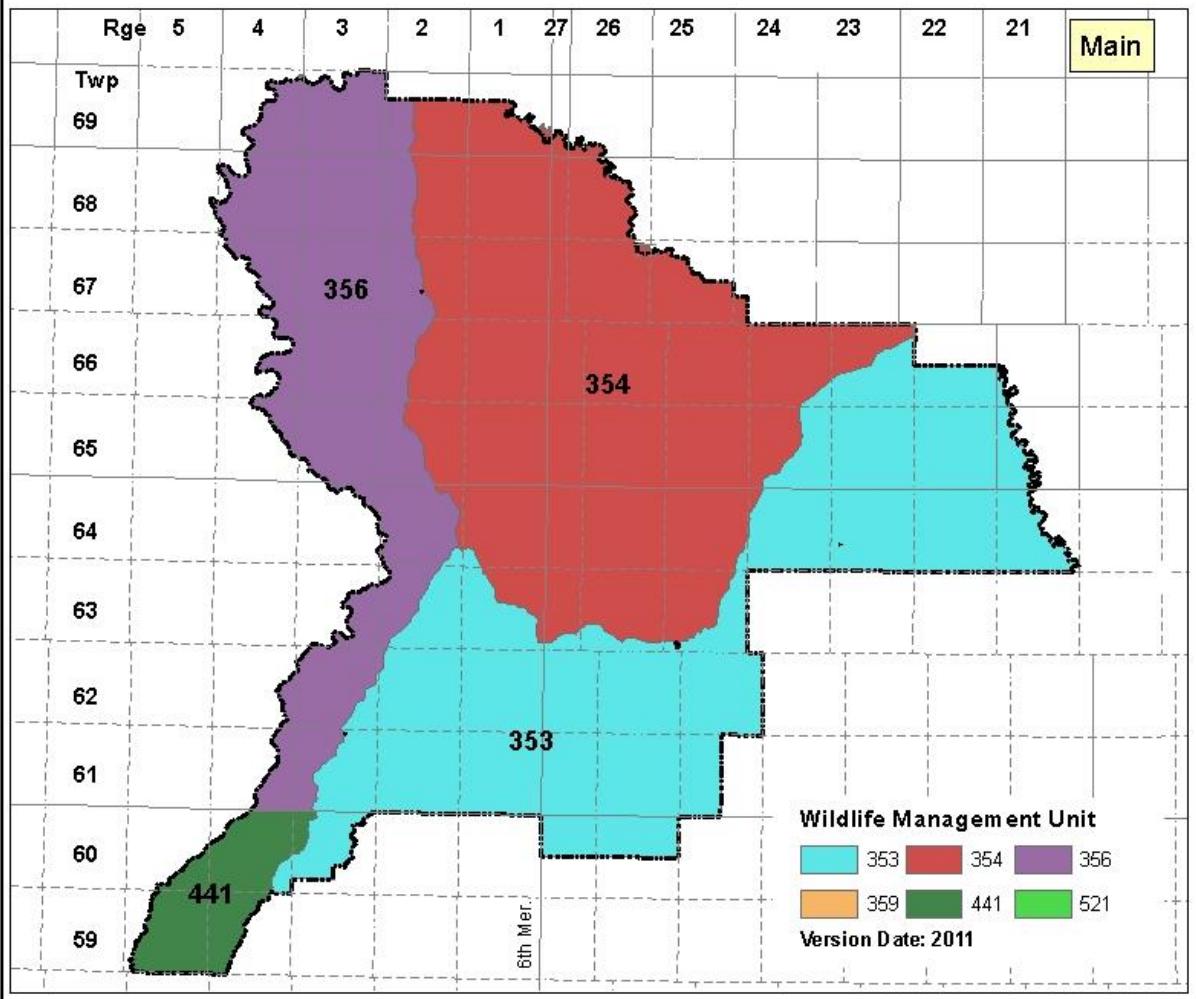


Figure 61 Wildlife Management Units



4 Summary of Previous FMP and the Management Outcomes

Performance monitoring of management assumptions included in FMPs are key to ensuring companies are acting as diligent stewards of the forest and are doing what they are saying they are going to do in the forest. It also acts as a check and balance to adapt in cases where the conditions change, new information or science has been developed, or the strategies committed to prove to be ineffective.

AESRD requires that companies complete Stewardship Reports every five years. Canfor is also required to complete annual reports each year to track performance to the Values, Objectives, Indicators, and Targets (VOITs) committed to in the Sustainable Forest Management Plan in order to maintain CSA certification. Although Canfor has not completed a formal stewardship report at this time, in lieu of this, performance monitoring has been reported annually in Canfor's Annual Performance Monitoring Reports as required to meet CSA requirements. The following sections provide a brief summary of management outcomes and performance in regards to Canfor's 2003 Detailed Forest Management Plan.

4.1 Summary of the Previous Forest Management Plan

Canfor's 2003 Detailed Forest Management Plan (2003 DFMP) was approved in November 2003. The approved coniferous AAC under this plan was 630,400m³ and the approved deciduous AAC was 451,726m³. The TSA demonstrated an increase in sustainable coniferous harvest level to 670,000m³ after the second decade. Key considerations that were used in the development of the 2003 DFMP included:

- Wood flow including both coniferous and deciduous timber volumes;
- Watershed protection achieved by limiting the amount of vegetation cover removed within a defined watershed;
- Maintenance of habitat conditions required for the selected indicator species; and
- Maintenance of seral stages within a natural disturbance regime.

As a result of heavy MPB flights into the region in 2006 and 2009, Canfor was directed by AESRD to implement a MPB strategy through an amendment of the 2003 DFMP. Targeting to remove 75% of the susceptible pine within 20-years, Canfor submitted the Healthy Pine Strategy (HPS) in 2009. The HPS received AESRD approval in January 2010.

The HPS resulted in an increase of approximately 85,000m³/year as a result of targeting the removal of susceptible pine, with an AAC of 715,000m³. The deciduous harvest level remained the same as what was modeled in the 2003 DFMP during this time.

4.2 FMP Approval Conditions Status

The 2003 Detailed Forest Management Plan was approved by AERSD on November 3, 2003 with seven Approval Conditions to be completed by Canfor. Table 29 summarizes Canfor's performance to the 2003 DFMP Approval Conditions.

Table 29 2003 DFMP Approval Condition Status

Approval Condition	Requirement	Date	Achieved Performance
AC #1: Growth and Yield Monitoring	Effective monitoring and validation of DFMP assumptions is paramount to adaptive management, continual improvement and forest sustainability. Canfor will develop and implement a growth and yield monitoring plan designed to validate the yield assumptions used in the current Timber Supply Analysis (TSA).	3-May-04	Yes-Received GYMP Approval Letter from ESRD
AC #2: Variable Structure Retention Strategy (VRS)	Canfor must develop stand level management strategies to mitigate the impacts of forestry practices on biological diversity and wildlife habitat. Canfor, in its implementation of the plan must harvest stands as per the harvest sequence and provide structure retention in a range of patch sizes, tree species and sizes. This will ensure natural patterns across the landscape are maintained.	26-Aug-04	Yes-Received VRS Approval Letter from ESRD
AC #3: Timber Utilization	The department granted Canfor temporary relaxation of timber utilization requirements from 15/10 to 15/13 utilization and from using balsam fir. The following outlines Canfor's requirements for due diligence in respect of monitoring this temporary situation: a) Canfor's five-year Stewardship Report will assess and report the impact that these relaxation requirements have on DFMP objectives, the spatial harvest sequence and the sustainable timber supply (both coniferous and deciduous harvest levels).	June 30, 2009 - June 3, 2014	Yes-Received annual approvals from ESRD for utilization changes and have modeled Canfor's current utilization standard of 15/12 in the 2015 FMP
AC #4: Industrial Timber Salvage	Industrial timber salvage is charged to the AAC of the appropriate timber disposition on the FMA. The DFMP however, does not address the magnitude of the timber drain or how it will be accounted for on the FMA through the plan period.	21-Jun-05	Yes-Received Merchantable Timber Drain Approval Letter from ESRD
AC #: Spatial Harvest Sequence (SHS)	The spatial (mapped) harvest sequence is the most important DFMP output as it implements the strategies the Company must follow to achieve the predicted future forest condition. Adherence to this planned harvest sequence is imperative. The Preferred Forest Management Strategy 20-Year Harvest Sequence map present the stands that are scheduled for harvest during this plan period. Canfor must follow the mapped harvest sequence as presented in the DFMP. If the SHS is not followed, a complete review of the harvest design to assess landscape issues will need to be undertaken.	1-May-09	Yes-Canfor completed an amendment to the 2003 DFMP to meet the MPB directive. The Healthy Pine Strategy was approved by ESRD January 22, 2010
AC #: Strategic Planning for Caribou	Canfor has committed to developing a Caribou Habitat Management Strategy that includes a habitat supply review and an evaluation of the current management practices. However, timelines for development of this strategy were not defined in the DFMP. The department requires this strategy to be completed in a timely fashion. a) Canfor will prepare an action plan for developing a Caribou Habitat Management Strategy that is acceptable to the Area Manager, Smoky Forest Area by December 31, 2003. Canfor will work in consultation with key department staff to develop this action plan.	16-Mar-04	Yes- Received Strategic Planning for Caribou Approval Letter from ESRD
AC #: Long Term Access Development Plan	Access development and management is a critical function in sustainable forest management and an essential component in implementing the spatial harvest sequence. Canfor's DFMP does not address the development of access corridors necessary to carry out its forest management and timber harvesting operations. a) Canfor will develop a forestry road corridor plan for the entire FMA in consultation with the Canfor Forest Management Advisory Committee. Canfor will obtain the written approval of the plan from the Smoky Forest Area Manager and the Senior Manager, Forest Planning Section by November 15, 2004.	18-Feb-05	Yes- Received Long Term Access Development Plan Approval Letter from ESRD



4.3 DFA Specific Issues

There were many challenges during the life span of the approved 2003 DFMP. The main issues were Caribou, MPB, underutilization of deciduous, and reduction of THLB due to increased landbase withdrawals from other industrial development.

Caribou

Canfor has voluntarily deferred harvest in certain operating areas in the Caribou range since 2005 based on consultation with AESRD. In order for Canfor to achieve the AAC that the sawmill depends on, Canfor had to increase harvesting of sequenced conifer outside the caribou range sooner than planned.

Mountain Pine Beetle

In 2006, there was a wind updraft from the western side of the Rocky Mountains that brought MPB north to western Alberta. This affected the Grande Prairie area and north of the Peace River. As a result, AESRD developed a MPB strategy and one of the strategies was for FMA holders to resubmit an amendment to the current approved FMP to address 75% removal of MPB pine susceptible stands. Canfor submitted an amendment which was approved in 2009. There was another infestation that occurred in 2009.

Addressing MPB has been a constant battle as Canfor has moved their operations to focus on higher impacted areas. Since the infestation in 2006 the log quality of infested pine is decreasing. Canfor's objective is to harvest these stands before they become uneconomical. MPB reconnaissance flights are done annually and Canfor keeps in constant contact with the AESRD Forest Health Officer and has moved their operations based on AESRD's recommendations. In some cases the SHS could not be followed resulting in larger variances. The following table outlines how well Canfor has addressed AESRD's MPB strategy (Table 30).

Table 30 MPB Mitigation Summary-Reduction of MPB Threatened Pine Stands

Operational Subunit	Total FHP Area (ha)	Total FHP Area (ha) with MPB Pine	Percent (%) FHP Area with MPB Pine
DN 4-5 Split	907.6	738.0	81.3
DS 3 North	1,046.5	833.8	79.7
E8 1 East	453.5	376.8	83.1
E8 1 West	733.1	690.3	94.2
E8 3A	1,421.0	1,387.6	97.6
ES 1A	149.4	88.3	59.1
ES 2-3 Split	1,422.2	864.2	60.8
ES3 Misery	632.9	528.6	83.5
Lat 1 Jackfish	268.0	160.6	59.9
Lat 1 SW	67.2	36.1	53.6
Lat 2 West	585.1	318.2	54.4
Lat 3 NE	760.1	486.7	64.0
Lat 3 NW	225.9	152.4	67.4
Lat 3 South	591.3	454.2	76.8
Peace 3A	2,993.7	2,519.3	84.2
Sim 1A	119.3	89.9	75.4
Sim 2 South	239.2	128.9	53.9
Sim 3A	1,629.7	1,337.7	82.1
Sim 4 East	358.1	188.3	52.6
Sim 4 West	1,198.8	662.9	55.3
Sim Tower	1,165.4	1,122.1	96.3
Smoky 1 NE	533.2	446.6	83.8
Smoky 1-3 Fpan	782.9	443.1	56.6
Smoky 2A	461.3	292.6	63.4
Smoky 3S	393.3	326.1	82.9
Smoky 4-5 Split	1,730.8	1,544.0	89.2
Smoky 6 Camp 10	389.0	299.1	76.9
Total	21,258.6	16,516.2	77.7

Deciduous

With deciduous quota holders under harvesting by 57% from 2009 to 2013, the deciduous SHS was not fully implemented. As a result of this underutilization, Canfor had to defer some higher deciduous volume mixedwood stands that were sequenced and sterilized some deciduous from within harvest blocks as there was very little market to sell to other companies. This increased Canfor's harvesting and reforestation costs and also resulted in some areas with lower volume infested MPB pine stands to be bypassed. These were all considerations included in this FMP.



Landbase Withdrawals or Other Industrial Development

Oil and gas extraction is very active on the FMA area. The reduction of timber harvesting landbase for oil and gas development is an issue on the FMA area. Between 2009 and 2013 there has been approximately 3,586ha withdrawn from the FMA area (Table 32). Canfor receives Timber Damage Assessment revenue from dispositions on the FMA area and uses these funds to lessen the impact on AAC by planting genetically superior trees, reforesting areas that have been burned, and reforesting sites that are suitable for tree growth like well sites that are no longer in use and seismic lines adjacent to harvest boundaries.

4.4 FMP SHS Variance Reporting

Canfor monitors FMP SHS variances to operational plans to ensure that the modeled future forest conditions will be met and that the AAC level remains sustainable. Table 31 summarizes Canfor's SHS variance using operational data from May 1, 2009 to April 30, 2013.

Table 31 SHS Variance Assessment Using Operational Data

Operational Subunit	Variance		Comments									
	10 Year SHS Area (ha)	Assessed SHS Area (ha)	Total (ha)		Defermals (ha)		Deletions (ha)		Planned (ha)		Assessed Area %	
			Addition (ha)	Planned (ha)	Addition (ha)	Planned (ha)	Addition (ha)	Planned (ha)	Addition (ha)	Planned (ha)	D&D Portion in 10yr	FMP SHS %
DN 4-5 Split	1158.8	1090.7	555.8	351.8	315.9	219.0	886.7	-6%	-183.1	46%	-602.9	49%
DS 3 North	1653.4	1539.5	932.6	113.9	11.0	595.9	720.8	-7%	-493.0	37%	-720.8	39%
E8 1 East	580.0	563.4	396.7	56.7	109.5	57.2	223.4	-3%	-110.0	29%	-183.3	30%
E8 1 West	905.4	978.6	502.7	230.4	433.7	42.2	706.3	-2%	-245.5	48%	-492.7	49%
E8 3A	1630.3	1628.0	959.2	461.8	627.8	41.0	1130.6	0%	-206.9	41%	-671.1	41%
EN 1 South (Deciduous)	2286.0	2226.0	1946.0	225.0	0.0	280.0	505.0	-3%	-55.0	12%	-340.0	13%
ES 1A (Conifer)	567.4	548.2	63.1	64.2	397.7	525.1	3% 398.8	-3%	-481.1	81%	-481.1	84%
ES 1A (Deciduous)	1828.0	1604.0	1254.0	148.0	0.0	350.0	498.0	-12%	-202.0	19%	-574.0	12%
ES 2-3 Split	1711.5	1576.7	1237.5	184.7	13.7	325.5	523.9	-8%	-154.4	20%	-474.0	8%
ES3 Misery	752.0	690.9	571.8	61.1	119.1	0.0	180.2	-8%	-58.0	16%	-180.2	8%
Lat 1 Jackfish	316.5	278.1	146.8	121.2	131.3	0.0	252.6	-12%	-10.1	41%	-169.7	12%
Lat 1 SW	181.4	178.6	33.0	34.2	75.2	70.3	179.8	-2%	-111.4	80%	-148.4	82%
Lat 2 West	483.8	479.8	444.4	140.7	35.4	0.0	176.1	-1%	105.3	7%	-39.4	7%
Lat 3 NE	764.5	763.2	745.1	15.0	18.1	0.0	33.1	0%	-3.1	2%	-19.4	2%
Lat 3 NW	306.7	305.3	111.4	114.5	193.9	0.0	308.4	0%	-79.4	63%	0%	-195.3
Lat 3 South	144.7	143.8	98.1	493.2	45.7	0.0	538.9	-1%	447.5	32%	-46.6	32%
Peace 3A	2546.0	2468.3	2042.0	951.7	343.9	82.4	1378.0	-3%	525.4	17%	-504.0	17%
Sim 1A	139.5	101.1	80.9	38.4	20.2	0.0	58.6	-28%	18.2	14%	-28%	-58.6
Sim 2 South	421.7	403.3	105.3	133.9	95.6	202.4	431.9	-4%	-164.1	71%	-4%	-316.4
Sim 3A	1522.3	1459.6	836.9	792.6	206.7	416.0	1415.3	-4%	169.9	41%	-4%	-685.4
Sim 4 East	455.5	439.6	127.7	230.4	29.6	282.4	542.4	-3%	-81.6	68%	-3%	-327.8
Sim 4 West	563.1	552.3	370.9	827.9	52.3	129.0	1009.2	-2%	646.6	32%	-2%	-192.2
Sim Tower	1257.0	699.6	604.8	560.6	94.9	0.0	655.5	-44%	465.7	8%	-44%	-652.3
Smoky 1 NE	979.7	975.5	359.9	173.3	615.6	0.0	788.9	0%	-442.3	63%	-619.9	63%
Smoky 1-3 Fpan	867.3	746.9	662.5	120.4	81.4	3.0	204.8	-14%	36.0	10%	-204.8	11%
Smoky 2A	513.0	508.2	325.9	135.4	182.3	0.0	317.7	-1%	-46.9	36%	-187.1	36%
Smoky 3S	410.0	403.7	283.3	110.0	112.5	7.9	230.4	-2%	-10.4	29%	-126.7	30%
Smoky 4-5 Split	1551.5	1441.3	957.7	773.1	341.6	141.9	1256.7	-7%	289.6	31%	-593.8	34%
Smoky 6 Camp 10	572.8	605.2	156.5	232.5	398.1	50.6	681.2	6%	-216.1	78%	-416.3	74%
Total	27159.8	25399.3	16995.7	7895.7	4769.3	3694.4	16359.4	-6%	-567.9	31%	-6%	-10224.1
												25,088.6

4.5 Landbase Changes

Several factors contribute to the reduction of landbase over time. Some are natural, such as insect and disease outbreaks or fire, and some are man-made such as the clearing of land for oil and gas activities. The cumulative impact of these factors can significantly affect the timber harvesting landbase and forest resource values. Table 32 summarizes the amount of area depleted from the Canfor FMA landbase in the last five years due to natural events or industrial withdrawals.

Table 32 Summary of Landbase Withdrawals and Depletions

Industrial Activity Removals by Disposition Types		Area Removed (ha)					
Disposition A	Disposition B	2009	2010	2011	2012	2013	Total
DML					0.03		0.03
DML	DLO			3.71			3.71
EZE		0.29	0.79	87.86		0.73	89.68
LOC		6.80	8.47	68.65	26.38	21.49	131.79
MIL			8.17	8.43	0.60	0.51	17.71
MIL	DML			3.13	2.74		5.87
MIL	SML				2.13		2.13
MIL	LOC			11.15			11.15
MSL		24.00	57.96	65.71	53.74	108.92	310.32
MSL	LOC	62.41	671.89	265.44	259.93	265.84	1,525.52
MSL	MIL		5.41				5.41
PIL		0.10	6.16	0.43	5.06	1.35	13.10
PIL	LOC		0.08	1.61	0.29	2.63	4.61
PLA		74.39	188.15	361.25	298.73	480.14	1,402.66
PLA	PIL	9.88	7.48	38.21	6.17	0.09	61.82
PLA	LOC			0.94			0.94
SML					4.27		4.27
Total		177.87	954.56	916.51	655.75	881.71	3,586.40
Natural Calamities		2009	2010	2011	2012	2013	Total
Area burned		2.9	6.8	-	-	492.4	502.1
Area disturbed by blow down		-	-	-	-	-	-
Area affected by insects		-	-	-	-	441*	441
Area affected by disease		-	-	-	-	-	-
Total		2.9	6.8	0	0	492.4	943.1

* MPB Rehabilitation Blocks

Table 33 Disposition Code Definitions

Disposition Code Definitions	
DML	ESRD Miscellaneous Lease
DLO	ESRD Licence of Occupation
EZE	Easement
LOC	AER License of Occupation
MIL	AER Miscellaneous Lease
MSL	AER Mineral Surface Lease
PIL	AER Pipeline Installation Lease
PLA	AER Pipeline Agreement
SML	Surface Materials

4.6 AAC Sustainability

It is important to track the amount of volume actually harvested each year and compare it to the AAC to ensure that over the quadrant period that the harvest levels are not exceeding the approved AAC. Table 34 compares the AAC to the actual volumes harvested on the FMA area for the last five years.

Table 34 Summary of AAC and Harvest Levels

Timber Year	AAC (m ³ /yr)		Volume Harvested (m ³)		Proportion of AAC Harvested	
	Conifer	Deciduous	Conifer	Deciduous	Conifer	Deciduous
2009	715,000	592,061	767,615	358,695	107%	61%
2010	715,000	592,061	659,278	433,756	92%	73%
2011	715,000	592,061	553,773	333,628	77%	56%
2012	715,000	592,061	713,604	205,920	100%	35%
2013	715,000	592,061	525,593	211,539	74%	36%
Total	3,575,000	2,960,305	3,219,863	1,543,538	90%	52%

Note: Current Deciduous allocation for both Norbord and Tolko is 452,529m³. The increase in AAC shown in the table includes reconciliation volume.

Table 35 shows the amount of timber salvaged from the FMA area from the 2009 to 2013 timber years. Salvage timber volumes fluctuate from year to year depending on the activities conducted within the FMA area.

Table 35 Salvage Timber

Timber Year	Coniferous (m ³)	Deciduous (m ³)
2009-2010	4,480	661
2010-2011	3,725	3,823
2011-2012	25,983	7,238
2012-2013	33,482	9,739
2013-2014	17,413	21,231
Total	85,083	42,692
Average	17,017	8,538

4.7 Growth and Yield Plan Implementation

The first approval condition of Canfor's 2003 DFMP required Canfor to develop and implement a growth and yield monitoring plan (GYMP) designed to validate the yield assumptions used in the 2003 Timber Supply Analysis.

The following objectives were outlined in the approval condition:

1. Meet the requirements of the Standards for Tree Improvement in Alberta (SRD, 2003).
2. Provide local empirical data to validate the yields forecast by the yield functions and strata used in the RTSA, including all post-harvest and natural strata.
3. Schedule establishment and re-measurement for both permanent (PSPs) and temporary sample plots (TSPs) for all yield strata as defined in objective 2.
4. Monitor the growth and dynamics of post-harvest regenerated (PHR) stands using detailed data collected during the establishment and performance surveys as per the Alberta Regeneration Survey Manual and the Alberta Regeneration Inventory System (ARIS) Industry Operations Manual. PSPs must be designed to monitor early stand height growth as well as seedling mortality and ingress. Identify genetically improved stock in regeneration survey and post-harvest PSP measurements.
5. Ensure that strata that predict greater than fire-origin yields (in the RTSA) meet the requirements of the Enhanced Forest Management (EFM) Technical Protocols (AESRD, 2000).
6. Develop a method to compare RTSA yield predictions for black spruce leading stands with current volumes available for harvest.

Canfor submitted a GYMP to AESRD on April 19, 2004 that met most of the objectives or outlined a plan to achieve the objectives in the FMP approval condition. The GYMP received AESRD approval on May 3, 2004.

As required in the GYMP, Canfor continued to measure PSPs in fire-origin stands on a regular 5-10 year schedule depending on stand age. Canfor also established five additional PSPs in pine-black spruce leading stands (Yield Group 10) to meet the under-representation of this group which was identified in objective 6 of the approval condition.

In addition to 91 managed stand PSPs that are part of Canfor's original PSP program, Canfor also developed a Post-Harvest Regenerated Stand (PHR) program in 2005 where a 1.67km grid was overlaid on the FMA area. When a block is harvested on the FMA area and overlaps a 1.67km grid point, Canfor establishes a PHR plot to measure and monitor the performance of Canfor's silviculture practices. These plots provide detailed site specific information on the success and effectiveness of planted wild and genetic stock, natural ingress, site preparation, and vegetation management practices to assess growth and yield performance on the FMA area as well as to monitor the success of operational practices.

Since 2005, Canfor has established 329 plots in its PHR program of which 13 are in natural stands to be used in the Alberta Biodiversity Monitoring Institute program. The PHR plots are re-measured every 5 years until the cutblock reaches age fifty, after which time they are re-measured on a 10-year cycle.

Canfor currently has 688 plots in natural stands and 419 plots in managed stands. Table 36 and Table 37 provide a history of Canfor's permanent sample plot measurement and establishment from 2004 to May 1, 2014.

Table 36 PSP Program Summary

YEAR	PSP PROGRAM (Number of Plots)					
	ESTABLISHMENT			REMEASUREMENT		
	NATURAL	MANAGED	TOTAL	NATURAL	MANAGED	TOTAL
2004		16	16	101		101
2005		2	2	154	12	166
2006	1	1	2	124	25	149
2007	5	2	7	156	33	189
2008			0	16	6	22
2009			0	10	16	26
2010			0	10	8	18
2011			0	71	26	97
2012			0	7	35	42
2013	1		1	76	6	82
2014			0	2		2
Total	7	21	28	727	167	894

Table 37 PHR Program Summary

YEAR	PHR PROGRAM (Number of Plots)					
	ESTABLISHMENT			REMEASUREMENT		
	NATURAL	MANAGED	TOTAL	NATURAL	MANAGED	TOTAL
2005	10	79	89			0
2006		48	48			0
2007	1	94	95			0
2008	5	3	8			0
2009	1	37	38			0
2010		17	17	1	81	82
2011		11	11		46	46
2012		17	17		94	94
2013		9	9		3	3
Total	17	315	332	1	224	225

Canfor also began surveying according to the *Reforestation Standard of Alberta* (AESRD, 2014b) in 2009, which provides a tool to measure and report the growth predictions of reforested stands in comparison to the yield predictions of the TSA. Information on Canfor's RSA performance can be found in Canfor's Annual Performance Monitoring Reports.



4.8 Seed Availability

To date, Canfor has been able to maintain a sufficient amount of seed supply to meet reforestation needs through cone collection, seed orchards, and purchasing seed from other sources when needed. Canfor's seed availability has been reassessed based on the Preferred Forest Management Strategy Spatial Harvest Sequence for the 2015 FMP. For further details on past seed availability and projected seed availability for the 2015 FMP refer to Canfor's Reforestation Strategy (Appendix G).

4.9 Practice Improvement Strategies

Ultimately, AESRD is responsible for timber harvesting and reforestation work occurring on Alberta's forested public land. AESRD must ensure that all commitments made in forest management plans and operating ground rules are met. AESRD does so through a formalized monitoring program called Forest Operations Monitoring Program (FOMP). FOMP has two sections: timber operations activities are monitored under Forest Operations Monitoring (FOM) and silviculture activities are monitored under Silviculture-ARIS Monitoring (SAM). When there are findings from FOM and SAM inspections/audits, AESRD requires action plans, appropriate corrective measures, and preventative actions be put in place by the Company.

A summary of enforcement incidents and their mitigation strategies are provided in Table 38.

Table 38 Summary of Enforcement Incidents

Date of Infraction	Date of Assessment	IRS #	Penalty, Warning, Waiver or Closed	Description	Mitigation Strategies/Action Plans	Completion Status
16-May-09	15-Nov-09	IRS # 4067	Warning	TMR 141.6 & TMR 141.7 (1)-late submission performance surveys to ARIS-early submission of establishment surveys and late submission of a performance survey to ARIS	In both cases closer checks and confirmation required before survey plan created, carried out and submitted to government.	Done
10-Jan-10	5-Oct-10	IRS #4031	Penalty	Forest Act Section 10 (self reported)-0.25ha Buncher trespass	Improved block pre-works with contractor foremen and operators. Require bunchers to have GPS and Canfor to provide block boundary shapefiles.	Done
9-Apr-10	5-Oct-10	IRS #4032	Penalty	Forest Act Section 10 (self reported)-0.02ha Buncher trespass	Improved block pre-works with contractor foremen and operators. Require bunchers to have GPS and Canfor to provide block boundary shapefiles.	Done
25-Nov-11	7-Feb-12	IRS #4300	Penalty	TMR 100 (1)a- 0.015 ha Buncher trespass	In order to ensure that operators understand expectations around boundaries an onsite prework will be held with the foreman and buncher operators prior to starting work on these blocks.	Done
1-May-12	28-Sep-12	IRS# 4462	Penalty	TMR 141.6 & TMR 141.7 (1)-late submission performance surveys to ARIS	Canfor staff will continue to annually analyze all survey due dates to ensure that no survey is scheduled late. Skid clearance dates will be checked against scheduled survey dates to ensure they are within legislative timelines. Develop a custom report that will be run annually to check that all blocks with skid clearance dates have surveys scheduled. Survey SWP will be updated to reflect this.	Done



4.10 VOIT Reporting

Canfor's first Sustainable Forest Management Plan was completed in 2000. The VOITs from this SFMP were included in the 2003 DFMP, and were revised in 2005. Canfor was the first company to include VOITs and performance monitoring targets in an FMP. As required for CSA certification, Canfor has completed annual reports to monitor performance to the VOITs listed in the SFMP, which link to the 2003 DFMP.

Copies of Canfor Grande Prairie's Annual Performance Monitoring Reports starting from 2000, can be found at: <http://www.canfor.com/environmental/plans#>

In 2006, AESRD developed the Alberta Forest Management Planning Standard (AESRD, 2006), which included the requirement to develop company specific VOITs that aligned with Annex-4 of the planning standard. Canfor's *2012 Sustainable Forest Management Plan* VOITs have been developed to align with Annex-4 and are included in the 2015 FMP (Section 9).



5 The Forest Management Planning Process

5.1 Alberta Forest Management Planning Standards

The structure and content of Canfor's Forest Management Plan is aligned with the requirements of the *Alberta Forest Management Planning Standard (AFMPS) ver. 4.1* (AESRD, 2006a).

5.1.1 FOREST MANAGEMENT PLANNING

Canfor believes that stakeholder involvement and public participation are critical to the successful development and implementation of the FMP. Through providing interested parties with the opportunity for consideration and contribution, a plan that meets social, economic, and sustainability objectives can be achieved. Canfor provides these opportunities through the incorporation of input and direction from the Plan Development Team, Forest Management Advisory Committee, and First Nations Consultation. The dynamics of each of these groups are described below.

5.1.1.1 Terms of Reference

Canfor developed and submitted a Terms of Reference (ToR) (Appendix B) for the development of the FMP in November 2010, which was approved by AESRD in April 2011. The ToR describes the process and timelines for the development of the FMP, and although the original timelines identified in the ToR were revised, the forest management planning process outlined was adhered to (Canfor, 2010).

The ToR describes the roles and responsibilities of the Plan Development Team (PDT) and various Technical Teams that may be required as a means of providing specialized technical or analytical information. It also provides direction in regards to public involvement, aboriginal involvement, conflict of interest and conflict resolution if needed during the forest management planning process.

5.1.1.2 Plan Development Team

A Plan Development Team (PDT) was assembled with the objective of producing the FMP using a consensus model. The FMP process requires the application of many different technical skills and interests. Final decisions on the content of the FMP resided with Canfor, as they are responsible for its implementation. As the regulatory agency responsible for forest management, AESRD is responsible for the approval of the FMP, along with any conditions that may arise.

The Plan Development Team members evolved over the development of the FMP, but always included a Canfor representative and AESRD Forest Management Branch planning lead as co-chairs, quota holder representatives, Fish and Wildlife biologists, and AESRD Area Forester. The quota holders provided input through the PDT and specific technical teams.

As certain components of the plan were completed, the PDT recommended those components received "agreement in principle" from AESRD.

At the final stages of the FMP development, the PDT included the following members:

Table 39 FMP Plan Development Team Members

Plan Development Team	
Canfor	Melonie Zaichkowsky (co-chair)
	Dwight Weeks
	Jon Taszlikowicz
AESRD	Jennifer Koch (co-chair)
	Greg Greidanus
	Craig Brown
	Mike Russell
	Adrian Mienke
Quota Holders	Fred Radersma (Norbord)
	Dave Beck (for Norbord)
	Tim Gauthier (Tolko)
	Ian Whitby (for Tolko)
Other	Jay Greenfield (Ecora-Modeling Consultant)
	Gyula Gulyas (THEXLWIZ Consulting Ltd-G&Y Consultant)

The PDT enlisted the support of Technical Teams as a means of providing specialized technical or analytical information throughout the planning process. The teams included Canfor staff along with scientific experts from government, academia, and industry which provided technical input and guidance to ensure the plan reflects a sound and practical approach to sustainable ecological management consistent with the *Alberta Forest Management Planning Standard ver. 4.1* (AESRD, 2006a).

Technical Teams included:

- Growth and Yield: (Melonie Zaichkowsky-Canfor, Dwight Weeks-Canfor, Thompson Nunifur-AESRD, and Gyula Gulyas-Consultant) Purpose of this group was to develop natural and regenerated yield curves for the FMA area.
- Watershed: (Melonie Zaichkowsky-Canfor, Dwight Weeks-Canfor, Adrian Meinke-AESRD, Axel Anderson-Foothills Research Institute, John Diiwu-AESRD) Purpose was to ensure that watershed issues are incorporated into the FMP. Worked on incorporating the Equivalent Clearcut Area Watershed Assessment tool into the Patchworks TSA model and identifying appropriate stand recovery curves. Also identified mitigation strategies that can be applied operationally in watersheds of high risk.
- Net Landbase: (Melonie Zaichkowsky-Canfor, Dwight Weeks-Canfor, Greg Greidanus-AESRD, Jennifer Koch-AESRD, and Jay Greenfield-Consultant) The purpose of this team was to define all aspects of the landbase for modeling. The team identified processes and gathered datasets to net down the landbase and identify the Timber Harvesting Landbase (THLB) to be used in the Timber Supply Analysis.
- Wildlife: (Melonie Zaichkowsky-Canfor, Dwight Weeks-Canfor, and Mike Russell-AESRD) The purpose of this team was to ensure that the FMP addresses all wildlife habitat issues as per the

AFMPS. This included identifying Trumpeter Swan habitat, incorporating a Barred Owl Habitat Suitability model into Patchworks, Grizzly Bear RSF analysis, and extensive discussions regarding caribou habitat management strategies for the Little Smoky and A La Peche caribou ranges.

- **Fisheries:** (Melonie Zaichkowsky-Canfor, Dwight Weeks-Canfor, and Adrian Meinke-AESRD) The purpose of this team was to identify methods in which to assess risk to fish (specifically Bull Trout and Arctic Grayling) on the FMA area. This team developed a flow chart that identified the process of how to assess the risk to fish over time using AESRD's method of road density threshold, developed mitigation strategies that would help reduce risk to fish, and identified ways to prioritize where resources should be applied to implement the mitigation strategies to be most effective.
- **Mixedwood Management:** (Melonie Zaichkowsky-Canfor, Dwight Weeks-Canfor, Jon Taszlikowicz-Canfor, Fred Radersma-Norbord, Dave Beck-Norbord, Ian Whitby-Tolko, Tim Gauthier-Tolko, Craig Brown-AESRD) Comprised of the primary forest tenure holders and government representation, the mandate of this group is to incorporate concepts of integrated forest management while acknowledging the interests of the individual companies. This included discussions on how mixedwood stands would be modeled for the Timbers Supply Analysis, understory management strategies, silviculture strategies, and scheduling of natural stands in the spatial harvest sequence.
- **VOITs Alignment:** (Melonie Zaichkowsky-Canfor, Dwight Weeks-Canfor, and Jennifer Koch-AESRD) The purpose of this team was to ensure that the AFMPS, CSA SFMP, and Canfor Corporate Indicators aligned as much as possible. The team often sought the advice of others to provide specialized technical and analytical advice to ensure that the VOITs were relevant and meet the intent of the AFMPS.

5.1.1.3 Gantt Chart

The ToR submitted to AESRD in 2010 included a Gantt Chart which outlined the expected timelines for development and completion of milestone steps in the FMP planning process. As the submission date of Canfor's FMP was extended several times while awaiting direction regarding Caribou Range Plans, it was difficult to maintain a Gantt Chart that was current and relevant. Several milestones such as landbase assignment and MPB constraints had to be re-visited through the process in order to make them relevant as time and knowledge progressed. Canfor and AESRD remained cognizant of changing submission dates and updated information throughout the process to ensure that the development of the FMP remained on track. Figure 62 FMP Timeline summarizes the FMP planning process timeline and completion dates of milestone steps.

2006-2008	<ul style="list-style-type: none"> •Color IR photos collected for the FMA area
2009-2011	<ul style="list-style-type: none"> •GreenLink Forestry completed AVI Softcopy retrofit •Included an understory enhancement program to spatially identify understory stands in the AVI •The results of the understorey enhancement program were summarized in a final report (Results of Field Understorey Enhancement Survey for Forest Management Agreement 9900037-June, 2011) and submitted to ESRD for review and distributed to the PDT
2010 November 18 th	<ul style="list-style-type: none"> •FMP Terms of Reference (ToR) and Public Involvement Plan (July 31, 2008) submitted to ESRD for approval
2010 August 4 th	<ul style="list-style-type: none"> •Canfor receives letter from ESRD identifying First Nations that should be consulted for the development of the FMP
2011 April 4 th	<ul style="list-style-type: none"> •Canfor received ESRD approval for modeling approach and use of Patchworks for FMP Timber Supply Analysis
2011 April 6 th	<ul style="list-style-type: none"> •FMP ToR and Public Involvement Plan approved by ESRD
2011 August 9 th	<ul style="list-style-type: none"> •Canfor received letter from ESRD stating that the Canfor AVI program had been successfully audited by the Resource Management Branch-dated August 9, 2011
2011 November 2 nd	<ul style="list-style-type: none"> •Canfor submits draft set of Values Objectives Indicators and Targets (VOITs) endorsed by public advisory committee to ESRD for review
2012 March	<ul style="list-style-type: none"> •Started setting up constraints in patchworks and running Timber Supply Analysis
2012 March 1 st	<ul style="list-style-type: none"> •Letters of Notice sent to Aseniwuche Winewak Nation, Sturgeon Lake Cree Nation, Horse Lake First Nation, and Metis Region 6 to advise of Canfor's development of a FMP and request meetings for initial consultation
2012 April 17 th	<ul style="list-style-type: none"> •Canfor submitted Growth and Yield Report to ESRD
2012 May 30 th	<ul style="list-style-type: none"> •Canfor submitted Landbase Assignment Document with FMP effective date of May 1, 2010
2012 July 31 st	<ul style="list-style-type: none"> •Canfor submits 2012 Forest Management Plan First Nations Consultation Plan to ESRD
2012 October 1 st	<ul style="list-style-type: none"> •Received agreement in principle for the 2012 Landbase Assignment Document and Growth and Yield Report from ESRD
2013 March	<ul style="list-style-type: none"> •Announcement that the Government of Alberta was developing a Caribou range Plan for the Little Smoky and A La Peche Caribou herds •Direction received from ESRD that Canfor should delay submission of the FMP until the completion of the range plan in order to incorporate strategies from the range plan into the FMP
2013 November 25 th	<ul style="list-style-type: none"> •Public Involvement Plan (revised April 13, 2013) submitted to ESRD for approval
2014 May 9 th	<ul style="list-style-type: none"> •ESRD reviews Canfor's initial set of VOITs and provides feedback
2014 August 6 th	<ul style="list-style-type: none"> •Canfor submits the revised Landbase Assignment Document (revised July 31, 2014) to ESRD to update the landbase with cutblocks and industrial disturbance to May 1, 2014 due to delays in the FMP submission for the development of the Little Smoky/A La Peche Caribou Range Plan •New FMP effective date May 1, 2014
2014 September 9 th	<ul style="list-style-type: none"> •Received agreement in principle for Public Involvement Plan (revised April 13, 2013) from ESRD
2014 September 11 th	<ul style="list-style-type: none"> •Canfor receives agreement in principle for the Landbase Assignment Document (Revised July 31, 2014) from ESRD
2014 December	<ul style="list-style-type: none"> •Canfor initiates requests for consultation with Aseniwuche Winewak Nation, Sturgeon Lake Cree Nation, Horse Lake First Nation regarding management assumptions used in the FMP and the selection of a SHS for the PFMS.
2015 January 30 th	<ul style="list-style-type: none"> •Canfor Forest Management Agreement #9900037 went to cabinet for early renewal and was ratified by the Province . The new FMA agreement is effective May 1, 2015 and states that Canfor will submit a Forest Management Plan on May 1, 2015.
2015 March 31 st	<ul style="list-style-type: none"> •Canfor receives notification from ESRD of Pre-Consultation Amendment with a requirement to consult Sucker Creek First Nation and update Canfor's First Nation Consultation Plan.
2015 April 7 th	<ul style="list-style-type: none"> •Canfor submits 2015 Forest Management Plan First Nation Consultation Plan to ESRD •Canfor sends Letter of Notice to Sucker Creek First Nation to advise of Canfor's development of a FMP and request a meeting for consultation.
2015 April 15 th	<ul style="list-style-type: none"> •Canfor presents spatial harvest sequence and management assumptions to the Forest Management Advisory Committee for feedback. First Nations groups are invited to the meeting and the meeting agenda and minutes are sent to all members.
2015 May 1 st	<ul style="list-style-type: none"> •Canfor submits 2015 Forest Management Plan to ESRD for approval.

Figure 62 FMP Timeline

5.1.2 PUBLIC INVOLVEMENT

Canfor has adopted public participation as an essential element in the development of the FMP (as identified as a requirement in the AFMPS (AESRD, 2006a)) and SFMP (as identified as a requirement in the CSA standard (CSA, 2008)). Canfor, as a steward of public lands, believes in the value of public involvement in discussing the company's planning, operations, and performance. Canfor's corporate policies and certification strategy clearly demonstrates the importance of public involvement to its business. Canfor will continue to be accountable to the public and will verify, by independent audit, that forestry operations are achieving present and future objectives.

5.1.2.1 *Canfor's Public Involvement Plan*

Canfor's *Public Involvement Program (PIP) for Canadian Forest Products Ltd. FMA #9900037* (Appendix C) outlines how Canfor will provide opportunities to inform the public and solicit input regarding forest resource management within the FMA area. The plan was revised April 13, 2013 and approved May 1, 2013 by Canfor's Forest Management Advisory Committee. The PIP was submitted and agreed to in principle by AESRD on September 9, 2014 (Canfor, 2013).

The PIP contains a conflict-resolution mechanism to assist in addressing competing land use conflicts and provides a mechanism for individuals, groups, and the general public to obtain information on how their concerns will be addressed. In the case of unresolved disputes, Government will arbitrate, and provide decisions that will be binding on all parties. It also provides information regarding the process for internal and external communication.

5.1.2.1.1 Forest Management Advisory Committee

Canfor recognizes the rights of stakeholders to be involved in the planning process to ensure that the public's concerns are addressed. Canfor accomplishes this by seeking representation from a variety of local stakeholders to participate in a public advisory group to Canfor.

The Canfor Forest Management Advisory Committee (FMAC) was initiated in September of 1995 and has been one of the longest running public advisory committees in Alberta. Consisting of individuals representing a broad range of interests⁸, the Canfor FMAC aims to ensure that



Figure 63 2012 FMAC Tour

⁸ The FMAC is currently (2015) comprised of members from Alberta Conservation Association, Alberta Fish and Game Association, Alberta Professional Outfitters Society, Alberta Trapper's Association, Aseniwuche Winewak Nation, Canadian Association of Petroleum Producers, City of Grande Prairie, County of Grande Prairie #1, DFA Related Worker, Grande Prairie and District Chamber of Commerce, Grande Prairie Regional College, Grande Prairie Regional Tourism Association, Horse Lake First Nations, M.D. of Greenview #16, Metis Nation Zone 6, Metis Local 1990/Metis Nation of Alberta, Peace Wapiti School Division No. 76, Public member(s) at large, South Peace Environmental Association, Sturgeon Lake Cree Nation, and Town of Valleyview.

sustainable forest management decisions are made as a result of informed, inclusive, and fair consultation with local people who are directly affected by or have an interest in the landscape and sustainable forest management.

The FMAC have in the past and continue to play a role for Canfor in:

- The development of its Public Involvement Program;
- The development of its Forest Management Plan;
- The development of its Sustainable Forest Management Plan for CSA certification;
- Periodically reviewing with FMAC the stakeholder representation on the advisory committee; and
- Pursuing CSA certification.

The Alberta Forest Management Planning Standard (AFMPS) (AESRD, 2006a) requires the public to play a role in defining values, objectives, indicators, and targets for forest management planning, periodic reviews, and ongoing participation of the advisory committee. Canfor's FMAC was very involved in the development of the Values, Objectives, Indicators, and Targets (VOITs) for inclusion in Canfor's 2012 *Sustainable Forest Management Plan* (Appendix H) that were subsequently aligned with Annex 4 of the AFMPS (Section 9) and included in Canfor's FMP.

Meetings

An important component that contributes to the success of the FMAC is its Terms of reference (FMAC, 2015); which clearly state the goals, operating rules, methodology of making decisions, and dispute resolution mechanisms by which the FMAC provides input to Canfor. The terms of reference state that semi-annual meetings will be scheduled, unless additional meetings are required. Wherever possible, meeting agendas address the needs of the Forest Management Plan and CSA certification.

Educational Opportunities

Providing educational opportunities to the FMAC provides knowledge for better dialogue and ultimately better decisions. Canfor has committed in the FMAC terms of reference to provide an educational opportunity at each FMAC meeting plus one field tour per year.



Figure 64 2014 FMAC Tour

The ability of people to share information, discuss and solve problems, and set and meet objectives is key to achieving and maintaining meaningful participation. At times, public members may feel limited in their ability to contribute to discussions because they lack the technical forestry knowledge. Broadening this knowledge enables better dialogue and helps contribute to balanced decisions. Some examples of educational opportunities include guest presentations on a particular topic, literature on specific

sustainable forest management targets, handouts, Forest Management Plans, and/or local association updates/briefings.

Review of the FMP

In addition to the feedback provided to develop meaningful and measurable VOITs, Canfor's FMAC reviewed the key strategies being applied to the FMP on April 15, 2015 and agree that they are consistent with the VOITs in which they helped develop and balance the forest resource values which are important to the local stakeholders. As a result of the review of these assumptions and related outputs, the FMAC has accepted the Preferred Forest Management Scenario that Canfor has chosen for the 2015 FMP and a summary of their feedback is provided in Table 40.

Table 40 FMAC FMP Review

Action	Description
#1	Reword Barred Owl SFMP Target 1.2.2c) statement: '100% of area of Barred Owl habitat will be within the 10 year forecast'
#2	Find a more appealing word to substitute in for 'genetically improved stock.' Typically when people hear this they assume genetic alterations/modifications have been implemented and it creates unnecessary concern.
#3	Remove the word 'plantation' and replace with 'planted areas.'
#4	Reword VOIT 1.2.2a) Caribou Target 3 to 'Canfor Alberta's contribution to open route density will be zero south of Deep Valley Creek'

5.1.2.1.2 Aboriginal Consultation

Canfor is committed to seeking traditional input and consideration from affected Aboriginal groups. Aboriginal groups including Sturgeon Lake Cree Nation, Horse Lake First Nation, Aseniwuche Winewak Nation, and Metis Nation Zone 6 are members of the FMAC and have opportunities to provide input to forest management decisions via regular FMAC meetings.

Canfor was sent a letter from AESRD dated August 4, 2010 that identified Sturgeon Lake Cree Nation (SLCN), Horse Lake First Nation (HLFN) and Aseniwuche Winewak Nation (AWN) as the First Nations that should be consulted for the Forest Management Plan (AESRD, 2010a). As required for Level 3, extensive consultation, Canfor completed and submitted a consultation plan to AESRD in July 2012.

Canfor initiated consultation with affected Aboriginal groups regarding the FMP in 2012. Early consultation efforts included presentations to the communities to provide background information about Canfor's obligations to complete an FMP, what is included in an FMP, and describing the kind of feedback and input that the Aboriginal groups could provide for consideration in the FMP. Canfor continued consultation efforts throughout the development of the FMP seeking feedback on cultural and historical sites of interest that could be excluded from the timber harvesting landbase; seeking input on constraints and strategies regarding watersheds, fish, and caribou; and providing maps and shapefiles of spatial harvest sequence scenarios to identify any areas of concern that may impact traditional use or sites.



On March 31, 2015, Canfor received a letter from AESRD requiring a First Nations Pre-Consultation Amendment for the FMP to include Sucker Creek First Nation due to recent traditional use area boundary changes, in addition to already identified AWN, HLFN and SLCN (AESRD, 2015d). The March 31, 2015 letter from AESRD also requested that Canfor's 2012 FMP First Nations Consultation Plan be updated to include current relevant timelines, and contacts, and to reflect the Pre-Consultation Amendment. Canfor submitted an updated consultation plan to AESRD on April 3, 2015 (Canfor, 2015b) and sent a notification letter and information package to initiate consultation with Sucker Creek First Nation on April 7, 2015. The First Nations Consultation Plan amendment was approved by AESRD on April 29, 2015.

6 Growth and Yield

6.1 Background Information

The *2012 Forest Management Plan Growth and Yield* report was submitted to Alberta Environment and Sustainable Resource Development (AESRD) on April 17, 2012. Canfor received a letter of agreement in principle from AESRD on October 1, 2012. At the time that the *2012 Forest Management Plan Growth and Yield* report was submitted, the effective date of the Forest Management Plan (FMP) was May 1, 2010 and due for submission September 2012. During that time, the submission date of the FMP was delayed for several reasons, but primarily due to the announcement of the development of AESRD's Little Smoky and A La Peche Caribou Range Plan. AESRD recommended that Canfor extend the submission of the FMP until the Little Smoky and A La Peche Range Plan was completed, so that all strategies from the range plan could be fully incorporated into the FMP. As a result, Canfor's FMP submission date was extended to May 1, 2015. In order to keep the FMP relevant, Canfor updated the net landbase and amended the Landbase Assignment Document. The *2015 Forest Management Plan Landbase Assignment* document was submitted on July 31, 2014 with a revised FMP effective date of May 1, 2014. Canfor received a letter of agreement in principle of the revised timber harvesting landbase and FMP effective date on September 11, 2014.

In discussion with AESRD, it was determined that the *2012 Forest Management Plan Growth and Yield* report should not be re-opened and amended despite the revised net landbase and FMP effective date because there were not any significant changes. Almost all updates are in regards to the managed stand strata transitions and deployment of genetic stock, which pose little to no risk to the actual approved yield curves. In order to summarize changes to the submitted *2012 Forest Management Plan Growth and Yield Report* as a result of the changed effective date, Canfor developed *Annex: 2012 Forest Management Plan Growth and Yield*.

6.1.1 GROWTH AND YIELD REPORT

The *2012 Forest Management Plan Growth and Yield* report documents the models, model inputs, and analytical procedures used to derive the yield tables for the Grande Prairie FMA area Timber Supply Analysis (TSA). The intent is to provide AESRD staff with the information necessary to review and approve the analysis methods, assumptions, and resulting yield tables. The document describes the processes undertaken to develop natural and managed stand yield tables for the 2015 FMP. A brief summary of these processes are stated below.

6.1.1.1 Stratification into Yield Groups

Canfor developed 17 yield groups for the natural forested landbase, which were based on a modification of the 2003 DFMP yield group stratification. The regenerating landbase was stratified into yield strata based on 3 Cutblock Assignment Rules: pre-1991 cutblocks (R1), post-1991 cutblocks (R2) and future cutblocks (R3). The landbase stratification rules were provided in two separate discussion papers to AESRD on November 25, 2011 and are also included in Canfor's *2015 Forest Management Plan Landbase Assignment* document (Appendix F).

6.1.1.2 Data

Canfor's Rotation 1 Permanent Sample Plot (PSP) data were used for the natural stand yield curve model development, and were stratified into the 17 yield groups based on spatially linked Alberta Vegetation Inventory (AVI) attributes of the approved net landbase area. Conifer volumes were compiled to a 15/12 utilization standard, and deciduous volumes were compiled to a 15/10 utilization standard with a 30 cm stump height.

Canfor's Regenerated Stand Productivity (RSP) study data were used to derive improved site index estimates for lodgepole pine and white spruce in cutblocks harvested prior to March 1, 1991. RSA performance surveys from 2009-2010 were used to derive yield curves for the regenerating landbase harvested post-1991.

6.1.1.3 Yield Curve Development

Natural stand yield tables (NSYT) were developed using the Growth and Yield Projection System (GYPSY May 2009) developed by Dr. Shongming Huang (AESRD). GYPHY curves were fitted separately for each Rotation 1 PSP measurement, and were localized to FMA conditions using PSP compiled basal area and top height / site index to "seed" the yield curves.

Managed stand yield tables (MSYT) were developed separately for all existing cutblocks harvested prior to 1991, harvested after 1991, and future cutblocks. MSYTs for future cutblocks were further divided into basic and genetic yield curves to reflect increases in yield resulting from the deployment of genetically improved stock.

MSYTs for pre-1991 cutblocks utilized the RSP study improved site index estimates for pine and white spruce, as well as the same method and data that were used for the development of the NSYTs. MSYTs for post-1991 cutblocks relied on the legislated RSA performance survey information. Basic yield curves for future cutblocks were derived by Canfor silviculturists using crop plans which considered recent silviculture performance, slight changes in silviculture regimes and anticipated future performance. Genetic yield curves for future cutblocks incorporated recently approved gains for pine and white spruce. Genetic curves were applied to all future cutblocks that are located within the approved boundaries of the tree improvement program deployment zones (B1 and G1) subject to seed availability.

6.1.1.4 Yield Validation

Canfor's Temporary Sample Plot (TSP) data, which was collected on the FMA area from the 1997 Volume Sampling Program, as well as the last measurement of the Rotation 1 PSPs were used to validate the natural stand yield curves.

Canfor's Growth and Yield Monitoring program (GYM)⁹ plots and Rotation 2 PSPs were used in validating managed stand yield curves by providing supporting evidence of observed trajectories versus predictions.

⁹ This name is used interchangeably with Post Harvest Regenerated Stand (PHR) plot program. Both references are referring to the same program.



For a detailed description of the processes and the natural and managed stand yield curves used in the TSA please refer to *2012 Forest Management Plan Growth and Yield* report (Appendix D) and Annex: *2012 Forest Management Plan Growth and Yield* (Appendix E).



7 Forest Management Strategies and Information

7.1 Forest Management Approach

7.1.1 ADAPTIVE MANAGEMENT

The Alberta Forest Management Planning Standard (2006a) (AFMPS) defines adaptive management as “The process of planning activities, implementing activities, monitoring results and comparing against planned results, and taking corrective action where unplanned results occur”. It is a learning approach to management that incorporates experience gained from the results of previous actions into decision making processes. It is a continuous process requiring constant monitoring and analysis of the results of past actions that are used to update current plans and strategies.

Canfor as a company has committed to the implementation of adaptive management in its *Sustainable Forest Management Commitments* (Canfor, 2012c):

We will use adaptive management to continually improve sustainable forest management by identifying values, setting objectives and targets for the objectives, and monitoring results. We will modify management practices as necessary to achieve the desired results.

Canfor’s 2015 FMP will be implemented through adaptive management, which makes provisions for changes to forest plans and strategies based on a process of scientific evaluation, monitoring, assessment, and feedback. Monitoring and stewardship reporting are an important component of the 2015 FMP. Sustainable forest management rests on Canfor’s ability to predict, to some degree, the future forest conditions resulting from various management plans and practices. Monitoring provides the necessary feedback on those predictions, and supports adaptive management. Through the monitoring required for Canfor’s CSA certification and AESRD’s stewardship reporting, data will be collected to learn more about the forest, and based on this “new” knowledge, management of the forest resources will improve.

In addition to applying adaptive management based on better science or knowledge gained from experience and performance monitoring, the AFMPS also requires adaptive management to occur if the current forest condition is significantly altered. If there is a natural calamity such as wildfire or MPB infestation that occurs on the FMA area and affects the net productive forest landbase by more than 2.5%, the forest management plan will need to be revised to account for a change in the forest condition (AESRD, 2006a).

7.1.2 ECO-SYSTEM BASED MANAGEMENT

Canfor formally introduced the concept of practicing eco-system based forest management (EBM) in the *2003 Detailed Forest Management Plan*. Canfor adopted a sustainable ecosystem approach for current and future plans and committed to improve its understanding of the ecological processes that have

produced natural forests and incorporate this knowledge into its daily operations. The importance and emphasis of practicing eco-system based forest management and sustainable forest management in Canfor's operations has continued and progressed in order to satisfy current CSA certification requirements and meet the *Alberta Forest Management Planning Standard* and are reflected in Canfor's *Sustainable Forest Management Commitments* (Canfor, 2012c). As such, the concept of EBM has formed the foundation of Canfor's current forest management practices.

The concept of EBM can be defined as: "A management system that attempts to emulate ecological patterns and processes, with the goal of maintaining and/or restoring natural levels of ecosystem composition, structure and function within stands and across the landscape" (CBFA, 2014b).

The CBFA *Status Report on Ecosystem-Based Management Policy Barriers and Opportunities for EBM in Canada* (CBFA, 2014b) suggests that the following best practices are essential to the implementation of EBM:

- *Apply principles of Integrated Land Management (ILM) to forestry planning (to the extent that is under forest industry's control), including efforts to cooperate with all forest road users to develop integrated road management strategies and effectiveness monitoring protocols;*
- *Establish the natural range of variation using empirical data and computer simulation tools (e.g. LANDIS, ALCES);*
- *Report the current forest condition and expected changes in the future against NRV for broad species composition, age class structure, and harvest patterns;*
- *Develop natural pattern emulation strategies for stand and forest floor conditions;*
- *Co-operate in advancing scientific understanding of cumulative effects from other sectors and climate change impacts; and*
- *Develop spatially explicit forecasts and monitor outcomes in an active adaptive management context (p. 3).*

Canfor is actively implementing these EBM best practices in its daily operations and forest management planning process. Many of the best practices are key elements of the FMP and Canfor's 2012 *Sustainable Forest Management Plan*.

7.1.3 LAND-USE FRAMEWORK

Alberta initiated a Land-use Framework process in 2005 that had input from public, stakeholders, First Nations, and Metis. The final Land-use Framework guiding document was completed in December of 2008. There were seven land-use regions defined (Figure 65). The FMA area is solely within the Upper Peace Region and is approximately 7,427,032ha. The first regional plan was for the South Saskatchewan Region, approved by Cabinet on July 23, 2014. The Upper Peace Regional Plan has not been started to date.

"The Land-use Framework consists of seven basic strategies to improve land-use decision making in Alberta" (GoA, 2008).

1. *Develop seven regional land-use plans based on seven new land-use regions;*
2. *Create a Land-use Secretariat and establish Regional Advisory Council for each region;*
3. *Cumulative effects management will be used at the regional level to manage the impacts of development on land, water and air;*
4. *Develop a strategy for conservation and stewardship on private and public lands;*
5. *Promote efficient use of land to reduce the footprint of human activities on Alberta's landscape;*
6. *Establish an information, monitoring and knowledge system to contribute to continuous improvement of the land-use planning and decision-making; and*
7. *Inclusion of aboriginal peoples in land-use planning.*

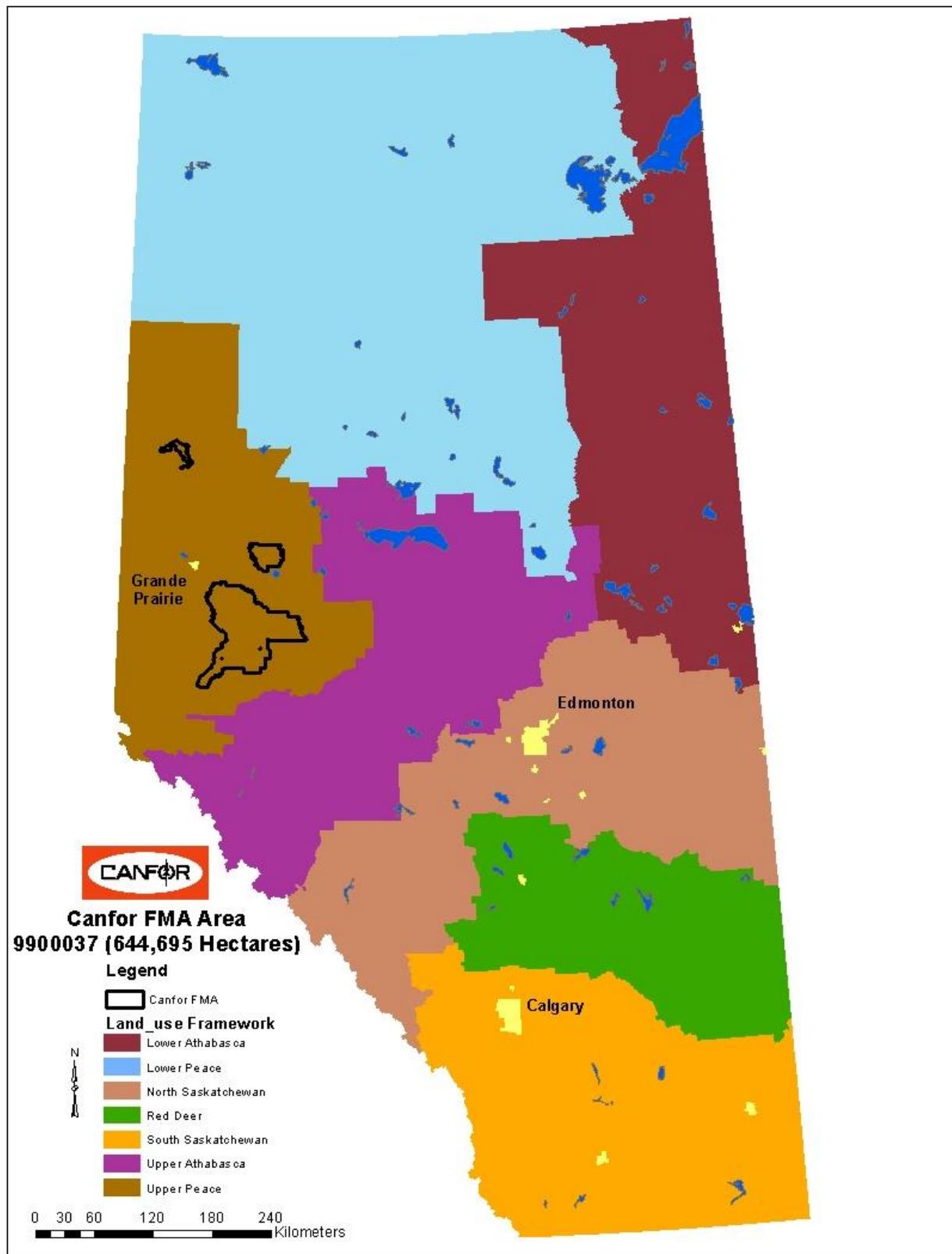


Figure 65 Land-use Framework Regions

7.1.4 CANADIAN BOREAL FOREST AGREEMENT

Canadian Forest Boreal Agreement was signed by Environmental Non-governmental Organizations (ENGO) and the Forest Products Association of Canada (FPAC), of which Canfor is a member, on May 18, 2010. The goal of the agreement is “a jointly supported outcome that is viewed as a globally and nationally significant precedent for the boreal forest conservation and forest sector competitiveness and results in Canada being recognized as a world leader in conservation and protection of boreal biodiversity and forest products from FPAC members being recognized as a climate-friendly choice in the marketplace and the preferred global source supply of sustainable forest products” (CBFA, 2010).

CBFA has designated six strategic goals:

- World-leading forest practices standards (Goal 1);
- Network of protected areas (Goal 2);
- Recovery of species at risk (Goal 3);
- Climate change (Goal 4);
- Forest sector and community prosperity (Goal 5); and
- Recognition by the marketplace (Goal 6).

CBFA has a Steering Committee, Independent Secretariat, and Regional and National working groups that include a Science Committee. The working groups are developing recommendations for an Action Plan for the recovery of woodland caribou in specific areas, providing recommendations to combat and adapt to climate change, and providing ecosystem-based management guidelines for participating companies to use to improve their forestry practices. The BC/AB Regional Working Group (BC/AB RWG) has been actively meeting since April 2010.

7.2 Natural Range of Variation

As stated by Andison (Andison D. , 2000): “One of the strategies for achieving EBM that is becoming more popular is using the “natural range of variation” as a template for forest management”. Natural Range of Variation (NRV) is a concept in which forest managers can emulate natural patterns of ecosystem structure and composition to direct forest management activities (CBFA, 2014a).

It has been found that due to the increased presence of anthropogenic disturbance on the landscape, current landscape patterns significantly differ from historical landscape patterns. This in turn may result in decreased ecosystem biodiversity on the land. In order to mitigate the impact of increased anthropogenic disturbance, species diversity, populations, and distribution can be balanced through the maintenance of the natural range of ecosystems across a landscape (CCFM, 2003).

The concept of NRV is one in which forest managers aim to mimic the range of ecosystem structures and processes that were present on the landscape prior to being influenced by non-aboriginal humans. NRV is based on historical fire and disturbance patterns, knowledge from aboriginal elders, historical databases, and archives. Targets for the landscape are determined based on historical information on disturbance patterns in efforts to move the forest to a state that more closely fits its natural range of variation.

7.2.1 OVERVIEW AND GO FORWARD PLAN

The concept of ecosystem based management was the foundation of Canfor's 2003 *Detailed Forest Management Plan*. Although the indicators and measures of ecosystem biodiversity have evolved, the overarching principles remain the same. Canfor's CSA certification has provided the basis for implementation of EBM and NRV as the Canadian Council of Forest Ministers Criterion and Indicators require that management strategies to maintain ecosystem diversity are implemented, monitored, and measured. "By designing harvesting and other silvicultural activities to minimize edge habitat or to emulate natural disturbances, forest managers may help minimize the impacts of these activities on biodiversity. This requires information on the frequency, intensity, pattern, and predisposing factors of natural disturbances" (CCFM, 2003). Canfor's 2012 *Sustainable Forest Management Plan* was developed to address these criterion and indicators as well as to provide forecasts of future forest conditions. This also follows suit with the requirements of the Alberta Forest Management Planning Standard Annex 4. Although not formally referenced as EBM and NRV in the AFMPS, the course filter approach to these concepts is inherent in the requirements of Annex 4.

7.2.1.1 Current Approach to NRV

Canfor is currently using distribution of forest type, old interior forest, patch size, age class distribution, and seral stage as indicators to achieve NRV. Through research on fire history, frequency, and distribution, as well as historical disturbance patterns on Canfor's FMA area, the current and forecasted state of the forest can be compared to historical fire return intervals. This analysis enabled Canfor to set targets and include them in the Timber Supply Analysis (TSA) of the FMP. The timber supply model was constrained to achieve the objectives of these indicators and once implemented operationally, will ultimately move the forest to a state that more closely emulates the historical disturbance patterns and natural range of variation. Details regarding each of these indicators can be found in the following sections.

7.2.1.1.1 Distribution of Forest Type

Tree species composition, stand age, and stand structure are important variables to the biological diversity of a forest ecosystem. Ensuring a diversity of tree species within their natural range of variation improves ecosystem resilience and productivity and positively influences forest health. This guides forest managers in maintaining the natural forest composition in an area and lends itself to long-term forest health and productive forests that uptake carbon. Canfor has targeted to "Maintain the current baseline percent distribution of forest types (treed conifer, treed broadleaf, treed mixed) >20-years old into the future" (Canfor, 2014a).

Indicator 1.1.2 from Canfor's 2012 *Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure distribution of forest type meets forecasted TSA projections.

7.2.1.1.2 Old Interior Forest

Old interior forest is a habitat requirement for certain species. Harvesting and other disturbances such as fire have historically reduced the amount of old growth habitat and have fragmented larger old growth stands that would meet the habitat requirements of those species. According to Annex 4 of the

AFMPS, old interior forest is defined as: “A forested area greater than 100 hectares in size located beyond edge effect buffer zone along the forest edge. For interior forest objective use a common age definition for all cover classes to prevent breaking up forest patches that have a common origin date” (AESRD, 2006a).

Indicator 1.1.3a) from Canfor’s *2012 Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure that the amount of old interior forest meets forecasted TSA projections.

7.2.1.1.3 Patch Size

Fragmentation of the forest landscape is an ecological concern for some plants and animals. Maintenance of a natural range of patch sizes will allow these species to continue their presence on the landscape. Patch size distribution targets were derived for the Boreal Forest and Foothills Natural Regions based on theoretical fire-return intervals (ORM, 2000). Targets for the Boreal Forest Natural Region were derived from measured patch size classes of four 20-year periods of unmanaged forests (Tanner & DeLong, 1996); while targets for the Foothills Natural Region were based on the distribution of patch sizes in historical pre-suppression air photos of the Foothills Model Forest in Hinton, Alberta (Andison D. , 1997). The model used for the TSA was constrained to achieve the targeted natural disturbance patch size classes (Table 41).

Table 41 Natural Disturbance Patch Size Classes

Reporting Areas	Percent by Area					
	1–100 ha		100–500 ha		500+ ha	
	LL	UL	LL	UL	LL	UL
FMA Area	10	16	14	25	53	82
Peace	14	23	13	25	52	73
Puskwaskau	14	23	13	25	52	73
Main	9	15	14	25	53	83
Notes:						
LL= Lower Limit; UL= Upper Limit						

Additional details regarding the application of patch size as a model assumption can be found in the TSA document (Appendix J).

Indicator 1.1.3b from Canfor’s *2012 Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure patch size distribution will achieve natural patch size distribution over the planning horizon.

7.2.1.1.4 Seral Stages

Seral stage can be defined as “the series of plant community conditions that develop during ecological succession from bare ground (or major disturbances) to the potential plant community capable of existing on a site where stand replacement begins and the secondary successional process starts again” (Canfor, 2014a). Seral stage targets are based on the natural range of variation and the assumption that

all native species and ecological processes are more likely to be maintained if managed forests are made to resemble forests created by natural disturbance agents, such as wildfires and wind. If anthropocentric disturbance regimes mimic naturally occurring disturbances, we are more likely to achieve biodiversity objectives over the long term. Seral stage distribution “is important for the conservation of biodiversity because it enables timber harvests to be planned so as to maintain a full range of successional habitats for wildlife and ecosystem types over the long-term” (CCFM, 1997).

Historically in Alberta, the Boreal Forest and the Foothills Natural Regions experienced frequent wildfires that ranged in size from small spot fires to large fires covering thousands of hectares. Natural burns generally contained unburned patches of forest, which result in a landscape of even-aged regenerating stands containing older patches of remnant forest. The implementation of a fire suppression policy circa 1950, timber harvesting, and other industrial activities all had an impact on the makeup of the forest in the FMA area. Effective fire suppression within Canfor’s FMA area resulted in an average annual burn rate of 50 ha/year from 1970-2013.

Canfor completed a modeling exercise to investigate the effect of natural disturbances and succession on the landbase. In consultation with AESRD it was determined that the appropriate fire return interval for the Boreal Forest Natural Region in Canfor’s FMA area is 60 years and the appropriate fire return interval for the Foothills Natural Region is 80 years. Based on this exercise, the seral stage targets in Table 42 were developed and applied to the timber supply model to help schedule harvest that will steer the FMA area towards its natural range of variability over the planning horizon.

Table 42 Seral Stage Targets

Seral Stage	Boreal (% Area)
	FRI (60 Years)
Pioneer	28
Young	43
Mature	18
Over Mature	6
Old	7
Seral Stage	Foothills (% Area)
	FRI (80 Years)
Pioneer	17
Young	31
Mature	24
Over Mature	9
Old	18

Additional details regarding the application of seral stages as a model assumption can be found in the TSA document (Appendix J).

Indicator 1.1.3c) from Canfor's 2012 Sustainable Forest Management Plan (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure seral stage distribution will meet forecasted TSA projections.

7.2.1.1.5 Retention

Natural disturbances (i.e. fire, floods, avalanches, wind events, insects, and disease infestations) rarely kill all trees within the disturbed area. Within all disturbance types, "skips" or "islands" result in patches of live and dead trees remaining within disturbed areas. "Retention areas should be designed to retain the natural range of stand and forest structures, maintain natural ecosystem function and biodiversity, provide habitat connectivity over the landscape, and supply natural refuges for the survival and dispersal of species after harvesting" (Harkema & Scott, 2002). The retention of single live trees and patches of live merchantable trees in harvest areas creates habitat in the harvested areas that is similar to that found within burned and other naturally disturbed areas. Retention of these different structure types across the landscape is an important component of ecosystem-based management.



Figure 66 Retention Patches

Harvesting operations can emulate the natural process of fire, and provide habitat in regenerating stands by retaining some residual live and dead trees in cutblocks. Canfor's operational planning process aims to design blocks that mimic natural disturbance and thus include the design of retention areas that simulate those that would be left behind in a disturbance.

Indicator 1.1.4a) from Canfor's 2012 Sustainable Forest Management Plan (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure representative merchantable structure retention is retained on the FMA area.

7.2.1.1.6 Fire Salvage Timber

Forest health can be influenced by many different factors including insect and disease, and natural calamities such as fire, strong wind events, flooding, and hail. Although these are all natural events, the occurrence of a large scale natural disturbance event on the Canfor FMA area poses an economic risk to the company. Timber lost to such events can have a significant impact to the Annual Allowable Cut which Canfor can harvest, and thus trigger a re-analysis of the timber supply available. In managed forests the objective is to minimize the economic impact of such



Figure 67 2013 Simonette Fire-Standing Merchantable Burned Timber

events through either suppression efforts or timber salvage operations.

Depending on the type of natural disturbance event, there is generally a window of time in which the impacted timber can be economically salvaged before decay makes it unsuitable for the manufacturing of forest products. Timber salvaging can also reduce the risk of additional or larger insect and disease outbreaks, which lead to increased risk of large fires in dead timber. Canfor recognizes that timber salvage operations to maintain forest growth must be balanced with ecological factors in order to conserve biological diversity.

Although suppression efforts are implemented by the Government of Alberta and Canfor to reduce forest health issues and in turn economic impacts, the goal of timber harvesting is to emulate the amount and pattern of natural disturbance across the landscape as closely as possible in order to retain all natural ecological values. At the same time it is also recognized that it is important that some dead trees be left on the landscape to support natural ecological function.

Despite fire suppression efforts, there is always a risk that a fire will occur on the FMA. Salvaging of fire killed timber to maintain forest growth must be balanced with allowing some burned areas to remain as habitat for plants and animals that require freshly burned forest for their survival. When a fire occurs on the FMA Canfor endeavors to ensure that the structure of the natural disturbance is retained in order to support the biological diversity that is specific to a fire. In support of this, Canfor follows AESRD's *Directive No. 2007-01: Fire Salvage Planning and Operations* (AESRD, 2007) which requires companies to develop fire salvage plans that "utilize as much of the fire-killed timber as possible within two years of the fire event, while maintaining environmental values" (AESRD, 2007). The Directive specifies the amount and type of un-salvaged forest structure that must be maintained and represent a range of burned severities from the fire. Through adhering to this Directive Canfor is balancing economic needs with preserving ecological function.

Indicator 1.1.4d) from Canfor's *2012 Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure that fire salvage plans are developed and implemented in conformance with AESRD's Directive.

7.2.1.2 Future Approach to NRV

As mentioned above, the CBFA has six (6) Goals. Goal 1 states that: "World leading Boreal "on-the-ground" sustainable forest management practices based on the principles of ecosystem-based management, active adaptive management, and third-party verification" (CBFA, 2010) will be developed and implemented. As a signatory to the Canadian Boreal Forest Agreement, Canfor has committed to "...using knowledge of natural patterns of ecosystem structure and composition to guide forest management activities" (CBFA, 2014a). As such, an NRV analysis that can be implemented "on-the-ground" is required under Goal 1.



Figure 68 2013 Simonette Fire-After Salvage Logging

In order to meet the Goal 1 NRV requirement as well as implement a more scientifically sound and relevant approach to NRV Canfor has embarked on a Forest Resource Improvement Association of Alberta (FRIAA) project with Weyerhaeuser Company Ltd. (Weyerhaeuser) titled *Historical Landscape Condition Benchmarks for Northwestern Alberta* (Crosina, 2014). The objective of the project is to "...create stand-alone, scientifically defendable output in the form of historic landscape conditions for an area that includes both the Weyerhaeuser Grande Prairie FMA and the Canfor Grande Prairie FMA" (Crosina, 2014). In order to enhance the current EBM and NRV strategies that will be applied in this FMP, Canfor endeavors to develop defendable measures and NRV landscape condition benchmarks for the FMA area. Dr. David Andison (Bandaloop Landscape Ecosystem Services) is a national expert who specializes in the study of NRV, historical disturbances and disturbance patterns, and has developed a simulation model called LANDMINE to complete an NRV spatial analysis specific to the FMA area. "The output from this research will be useful in understanding local landscape ecosystem dynamics, and will help lay an ecologically based foundation with which to compare desired future landscape scenarios by forest managers in long-term plans" (Crosina, 2014).

It is anticipated that this project will be completed by the end of 2015. The results from the NRV analysis will be used to set targets for future forest management planning.

7.3 Watersheds

Watersheds are key topographical features of a landscape that direct water, organic matter, dissolved nutrients, and sediments into specific lakes and streams. Activities that occur within a watershed boundary can directly influence the timing of water flows, groundwater recharge, stream bank stability, fish habitat, water temperature, water quality, and water quantity in the tributaries within that watershed. Altering these values has proven to impact watershed biodiversity and ecological function. Natural disturbance such as fire and MPB, and human disturbance such as harvesting and road construction will affect the forested condition and ultimately influence water values. Activities both natural and anthropogenic that result in stand replacing disturbance can change the stream flow regime and alter the frequency, timing, and magnitude of both peak and low flows throughout a watershed. This can lead to an increased frequency and magnitude of downstream flood events during spring melt and heavy weather events, which may cause crossing structures such as culverts and bridges to fail, and further exacerbate sediment loading and habitat fragmentation through increased occurrence of hanging culverts (Wong, Environmental Impacts of Mountain Pine Beetle in the Southern Interior, 2008). Increased peak flows can also change stream geomorphology, influence substrate movement, and undermine bank stability. Decreased water quantity during low flows can alter water temperature regimes and reduce aquatic habitat quantity and quality. Changes in flow regimes can transform fish habitat and render habitat that was previously important no longer suitable.

In order to protect these values and mitigate potential impacts of roads and harvesting activities on watersheds, Canfor conducted a watershed hazard assessment to identify the impacts of the Preferred Forest Management Scenario on all watersheds within the FMA area. The watershed hazard assessment is intended to assess the impact of natural and human made disturbances within a watershed. Canfor implemented AESRD's *Watershed Hazard Assessment Application* (AESRD, 2010c) in order to assess the impact of natural and human caused disturbances on each watershed. The application is particularly

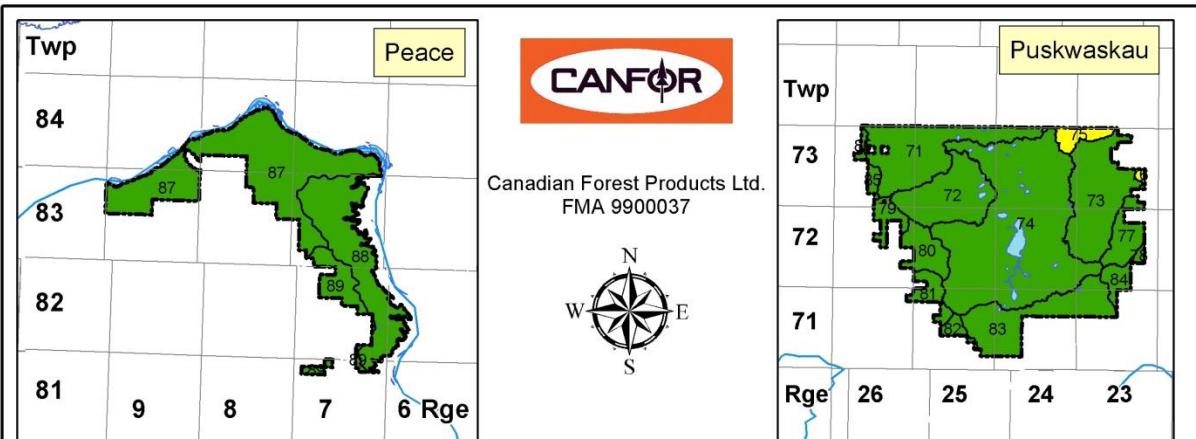
“designed to assess the impact of harvesting over time on individual watersheds within an FMA using the spatial harvest sequence and net-landbase” (AESRD, 2010c).

7.3.1 MANAGEMENT STRATEGIES

The Watershed Hazard Assessment defines all watersheds with an Equivalent Clearcut Area¹⁰ (ECA) greater than 50% ECA as high risk and recommends that mitigation strategies be applied to these watersheds (Section 7.3.1.1). Due to the need to manage for other competing values such as caribou and Mountain Pine Beetle on the FMA area, Canfor is aware that certain watersheds have the potential to become high risk. To mitigate this, Canfor constrained the timber supply model to not exceed 50% ECA in any watershed when selecting stands to sequence. As a watershed approaches the 50% ECA level, the model does not schedule additional harvest until previously harvested stands recover. In doing so, Canfor is still able to address pine stands with the highest susceptibility to MPB infestation while implementing the caribou management strategies in the FMA area without compromising watershed values above 50% ECA.

The current watershed risk level on Canfor’s FMA area is illustrated in Figure 69. The forecasted watershed risk level based on the TSA can be found in the TSA document (Appendix J).

¹⁰ Equivalent Clearcut Area is an indicator used to measure the relative loss and recovery of hydrologic function of a in a watershed with disturbance.



Watershed Risk Level Year 2014 SA63B

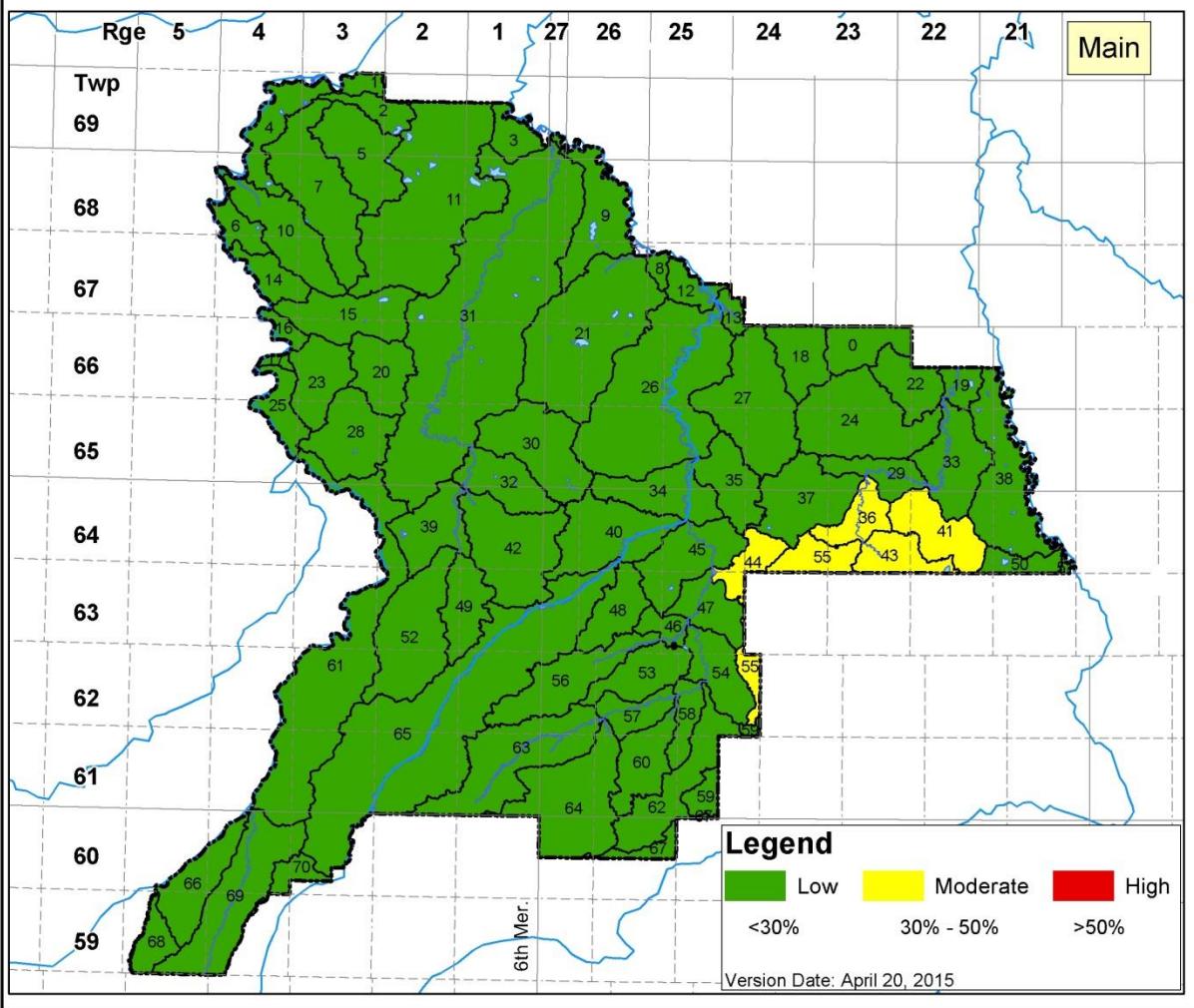


Figure 69 Canfor FMA Area Current Watershed Risk Level

Research has shown that the probability of occurrence of Bull Trout in watersheds where >30% of the sub-basin has been harvested is greatly reduced (e.g. 3x reduction in the probability of occurrence) (Ripley, Schimgeour, & Boyce, 2005). With this in mind and in conjunction with discussions with AESRD, Canfor will implement mitigation strategies and best management practices (Section 7.3.2) on all watersheds projected to have an ECA greater than 30% (moderate and high risk) based on the 10-year spatial harvest sequence.

Additional details regarding the application of ECA as a model assumption can be found in the TSA document (Appendix J).

Indicator 3.2.1a) from Canfor's 2012 *Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure that moderate and high risk watersheds have appropriate strategies implemented.

7.3.1.1 Watershed Hazard Assessment

The protection of watershed resources involves management for both water yield and water quality. Equivalent clearcut area (ECA) is a measure of the amount of area disturbed within a watershed multiplied by 1 – the hydrological recovery factor. ECA modelling in this analysis was originally carried out according to the procedure outlined in the AESRD document titled *The Equivalent Clearcut Area Method of Watershed Assessment for Forest Management Plans* (AESRD, 2011b). This document equates hydrological recovery to the percent of the culmination mean annual increment (MAI) that a stand has achieved where full recovery is achieved. For example, if a 100ha block with a culmination MAI of 4.2m³/ha/yr has regenerated and has a mean annual increment of 3.4m³/ha/yr, this stand would have an ECA of 19.04ha or 17% of the original block area (100ha * (1 – (3.4m³/ha/yr / 4.2m³/ha/yr))). Once a stand achieves full hydrological recovery at culmination the stand continues to grow in a fully recovered state even though the MAI falls below culmination MAI.

However, in reviewing this approach, many stands were taking a considerable amount of time to achieve full recovery and this was resulting in significant timber supply impacts when ECA constraints were enforced. Following a review of these results an alternative approach was provided by AESRD that utilized the culmination of current annual increment (CAI) using gross biological volumes as a measure of hydrological recovery. In order to implement this approach gross biological volume curves needed to be developed. Current annual increment was then calculated for each yield curve and the percent recovery then calculated as the 1- (current CAI / max CAI). Percent recovery is multiplied by stand area for each stand and these values are added for each watershed to determine the ECA for a particular watershed at a particular point in time.

ECA targets have been set up for each watershed in the FMA. As directed by AESRD, the ECA index for each watershed is based on the sum of ECA values divided by the gross watershed area (pers. Comm.

25-Oct-2012). Threshold values are established for each watershed at the 50% ECA index value, the lower limit of the high risk¹¹ category identified in the 2011 AESRD ECA document.

Fifty percent ECA targets have been enforced in the Preferred Forest Management Scenario (PFMS).

7.3.2 MITIGATION STRATEGIES

Through the development of this watershed management strategy, Canfor and AESRD have identified mitigation strategies and best management practices that can be planned and implemented in the moderate and high risk watersheds to reduce the risk to watersheds and water values on Canfor's FMA. Managing for watershed values and managing for sensitive fish species such as Bull Trout and Arctic Grayling are directly correlated. Many of these strategies and best management practices are directly or indirectly related to those developed to reduce the risk to fish (Section 7.4.1.4.3). Mitigation strategies in moderate and high risk watersheds may include, but are not limited to:

- Minimize the construction of new permanent roads and crossings and avoid wet areas utilizing LiDAR and Wet Areas Mapping;
- Minimize the construction of new temporary roads and crossings and avoid wet areas utilizing LiDAR and Wet Areas Mapping;
- Avoid multiple or redundant stream crossings of the same water body;
- Increase skid distances in high risk areas to reduce the need for temporary road construction;
- In streams that are considered fish bearing (intermittent, small perms and larger) and located in watersheds deemed as high risk, install crossings that do not alter the natural stream bed or restrict flow. In streams that are not considered fish bearing ephemerals, install crossings that are designed not to restrict larger anticipated flows;
- Ensure all road construction and crossing installations are completed to a high quality and include prompt sedimentation control measures;
- Identify the length of time temporary roads are going to be open and pre-plan the appropriate crossing for that length of time;
- Ensure all temporary stream crossings such as log fills and log bridges are removed prior to spring break-up to allow unimpeded flow and reduce the probability of sediment inputs;
- Ensure all operators are educated and fluent in stream crossing standards and why they are important;
- Ensure extreme operator diligence when removing temporary crossings to prevent stream and habitat degradation;
- Ensure activities are not causing water turbidity and sedimentation that may increase water temperatures;
- Promptly reclaim all temporary access and in-block roads when no longer needed. All reclamation must be completed to the highest possible standard to reduce the risk of sedimentation;

¹¹ High Risk Watershed= >50% ECA; Moderate Risk Watershed= 30-50% ECA; and Low Risk Watershed= <30% ECA

- Initiate integrated land management and shared access plans in areas where other stakeholders may be operating or have existing road infrastructure;
- Re-assess buffers in smaller streams (intermittent and ephemerals) to help with temperature regulation and to help filter sedimentation. Current practice is to leave lesser vegetation buffers and maintain machine free-zones along these streams, but in high risk areas a larger treed buffer may be required on large south facing slopes (Rex, Krauskopf, Maloney, & Tschaplinski, 2009). Small streams can be more sensitive to landscape disturbances than larger rivers (e.g. changes in flow, temperature, sediment loading, etc.). The smaller intact head water streams work to regulate many habitat functions that carry on downstream and alterations to these functions reduce the resiliency of the larger watershed to maintain historically importance aquatic habitat;
- When operating on large excessive slopes increase buffers and tree retention to reduce the risk of increased flows. Operating on steep slopes >35% may result in increased water flows into tributaries during peak flows and storm events, which in turn may result in a chronic sedimentation source and undermining channel;
- Maintain large woody debris within riparian areas to offer shade and cooler temperatures as well as hiding spots for young fish (Wong, Environmental Impacts of Mountain Pine Beetle in the Southern Interior, 2008);
- Minimize the temporal span of potential impacts post-harvest, ensure timely reforestation of harvested blocks;
- Plan for more winter harvest operations to reduce the amount of soil and lesser vegetation disturbance and potential sedimentation sources; and
- Focus planned retention in the moderate and high risk watersheds to help achieve landscape retention targets and also reduce the risk of erosion and increased flows.

Additional details on the implementation of some of these strategies can be found in Canfor's *Erosion and Sediment Control* booklet (Canfor, 2012b).

7.4 Species of Management Concern

While habitat for most species should be provided through the application of coarse- and medium-filter strategies (e.g., ecosystem representation and habitat elements, respectively), some species require specific management consideration to: 1) account for their specific habitat needs; 2) the fact that their populations are rare or very low; or 3) input from First Nations or stakeholders. These species have been termed Species of Management Concern (SoMC).

For all its operating areas including the Grande Prairie FMA area, Canfor has defined SoMC as species that occur within a Canfor operating area in a Defined Forest Area, and:

- Are wholly or partially dependent on forested habitat for one or more of their life stages; and
- Are potentially impacted by forestry planning and practices; and
- Meet at least one of the following:
 - Their habitat needs are not covered off by coarse and medium filter strategies;

- Have been assessed and recommended for listing as Endangered, Threatened, or Special Concern by COSEWIC under the Species at Risk Act;
- Are on the Species at Risk Act in Alberta;
- Are in SAS¹² (Species Accounting System) grouping number 4 (species using localized habitats);
- Are 'focal species' or of management or cultural concern as identified by a Canfor Public Advisory Group;
- Are Boreal Priority Species, as identified by the Canadian Boreal Forest Agreement;
- Are regionally rare or uncommon species that are sensitive to forestry operations; and
- Are a species of concern to local First Nations or the public, and that pass the test of 'reasonableness' to manage specifically for (e.g., their habitat is not fully covered by existing legislation or strategies and can be logically and practically managed for by Canfor).

All SoMC will be identified from an existing database of all vertebrate and invertebrate species occurring in the FMA area where each species is categorized according to its federal, provincial, and regional status, Conservation Framework priority, Species Accounting System group, and whether or not it was identified as a key species for local First Nations or the Forest Management Advisory Group. The identified SoMC are shown in Table 43 below, together with the primary Canfor – Grande Prairie 2012 *Sustainable Forest Management Plan* (SFMP) Indicator (Section 9) that defines management activities that impact that species. SoMC will be evaluated to determine if their habitat needs are adequately addressed through the SFMP coarse and medium filter¹³ indicators of ecosystem representation and habitat elements. If not, species-specific management strategies (fine filter¹⁴) will be developed for them (Table 43).

¹² Species Accounting System (SAS)- is used to indicate “how much favorable habitat is available at any time and how that habitat is distributed. Some species can be accounted for by relatively simple GIS layers; others cannot be and must be accounted for or monitored differently” (Bunnell & Vernier, 2007). The accounting system incorporates five groups of species determined by their response to forest practice and their accessibility to monitoring.

¹³ Course filter approach: maintaining vegetative communities, landscape patterns and processes within the limits of natural variability will result in the maintenance of the full complement of native plant and animal species.

¹⁴ Fine filter approach: a species-by-species approach.

Table 43 Species of Management Concern

English Name	Scientific Name	AB Wildlife Act Status	AB Status	COSEWIC	SARA	MBC	Primary SFMP Indicator	Species-specific Strategy Required?
AMPHIBIANS								
Long-toed Salamander	<i>Ambystoma macrodactylum</i>	SC (2010)	Sensitive	NAR (2006)	-	N/A	Riparian Management	No
Western Toad	<i>Anaxyrus boreas</i>	-	Sensitive	SC (2012)	1-SC (2005)	N/A	Riparian Management	No
Wood Frog	<i>Lithobates sylvaticus</i>	-	-	-	-	N/A	Riparian Management	No
BIRDS								
American Bittern	<i>Botaurus lentiginosus</i>	-	Sensitive	-	-	Yes	Riparian Management	No
American Three-toed Woodpecker	<i>Picoides dorsalis</i>	-	-	-	-	Yes	Structural Retention	No
Barn Swallow	<i>Hirundo rustica</i>	-	Sensitive	T (2011)	-	Yes	Representation of Plant Communities at the Landscape Level	No
Barred Owl	<i>Strix varia</i>	SC (2010)	Sensitive	-	-	No	Barred Owl	Yes – Barred Owl
Barrow's Goldeneye	<i>Bucephala islandica</i>	-	-	-	-	Yes	Riparian Management	No
Bay-breasted Warbler	<i>Setophaga castanea</i>	-	Sensitive	-	-	Yes	Distributions of Forest Type	Yes – Migratory Bird
Black-backed Woodpecker	<i>Picoides arcticus</i>	-	Sensitive	-	-	Yes	Structural Retention	Yes – Migratory Bird
Black-throated Green Warbler	<i>Setophaga virens</i>	SC (2010)	Sensitive	-	-	Yes	Seral Stage	Yes – Migratory Bird
Broad-winged Hawk	<i>Buteo platypterus</i>	-	Sensitive	-	-	No	Old Interior Forest	No
Brown Creeper	<i>Certhia americana</i>	-	Sensitive	-	-	Yes	Old Interior Forest	Yes – Migratory Bird
California Gull	<i>Larus californicus</i>	-	-	-	-	Yes	Representation of Plant Communities at the Landscape Level	No
Canada Warbler	<i>Cardellina canadensis</i>	-	Sensitive	T (2008)	1-T (2010)	Yes	Seral Stage	Yes – Migratory Bird
Cape May Warbler	<i>Setophaga tigrina</i>	-	Sensitive	-	-	Yes	Seral Stage	Yes – Migratory Bird
Common Nighthawk	<i>Chordeiles minor</i>	-	Sensitive	T (2007)	1-T (2010)	Yes	Representation of Plant Communities at the Landscape Level	Yes – Migratory Bird
Connecticut Warbler	<i>Oporornis agilis</i>	-	-	-	-	Yes	Seral Stage	Yes – Migratory Bird
Ferruginous Hawk	<i>Buteo regalis</i>	E (2010)	At Risk	T (2008)	1 (2010)	No	Representation of Plant Communities at the Landscape Level	No
Forster's Tern	<i>Sterna forsteri</i>	-	Sensitive	DD (1996)	-	Yes	Representation of Plant Communities at the Landscape Level	Yes – Migratory Bird
Great Blue Heron, herodias subspecies	<i>Ardea herodias herodias</i>	-	Sensitive	-	-	Yes	Riparian Management	Yes – Migratory Bird
Harlequin Duck (western population)	<i>Histrionicus histrionicus</i>	SC (2010)	Sensitive	-	-	Yes	Riparian Management	Yes – Migratory Bird
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	-	-	-	-	Yes	Representation of Plant Communities at the Landscape Level	Yes – Migratory Bird
Nelson's Sparrow	<i>Ammodramus nelsoni</i>	-	-	NAR (1998)	-	Yes	Representation of Plant Communities at the Landscape Level	Yes – Migratory Bird
Olive-sided Flycatcher	<i>Contopus cooperi</i>	-	May Be At Risk	T (2007)	1-T (2010)	Yes	Seral Stage	Yes – Migratory Bird
Peregrine Falcon, anatum subspecies	<i>Falco peregrinus anatum</i>	-	At Risk	SC (2007)	1-SC (2012)	No	Representation of Plant Communities at the Landscape Level	No
Purple Martin	<i>Progne subis</i>	-	Sensitive	-	-	Yes	Representation of Plant Communities at the Landscape Level	Yes – Migratory Bird

English Name	Scientific Name	AB Wildlife Act Status	AB Status	COSEWIC	SARA	MBC	Primary SFMP Indicator	Species-specific Strategy Required?
BIRDS cont.								
Red-necked Phalarope	<i>Phalaropus lobatus</i>	-	-	C (2011)	-	Yes	Riparian Management	Yes – Migratory Bird
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	-	-	-	-	Yes	Representation of Plant Communities at the Landscape Level	Yes – Migratory Bird
Rusty Blackbird	<i>Euphagus carolinus</i>	-	Sensitive	SC (2006)	1-SC (2009)	No	Riparian Management	No
Sandhill Crane	<i>Grus canadensis</i>	-	Sensitive	NAR (1979)	-	Yes	Riparian Management	Yes – Migratory Bird
Short-billed Dowitcher	<i>Limnodromus griseus</i>	-	-	-	-	Yes	Riparian Management	Yes – Migratory Bird
Short-eared Owl	<i>Asio flammeus</i>	-	May Be At Risk	SC (2008)	1-SC (2012)	No	Representation of Plant Communities at the Landscape Level	No
Sprague's Pipit	<i>Anthus spragueii</i>	SC (2010)	Sensitive	T (2010)	1-T	Yes	Representation of Plant Communities at the Landscape Level	Yes – Migratory Bird
Trumpeter Swan	<i>Cygnus buccinator</i>	SC (2014)	At Risk	NAR (1996)	-	Yes	Trumpeter Swans	Yes – Trumpeter Swan
Upland Sandpiper	<i>Bartramia longicauda</i>	-	Sensitive	-	-	Yes	Riparian Management	Yes – Migratory Bird
Western Grebe	<i>Aechmophorus occidentalis</i>	SC (2010)	Sensitive	SC (2014)	-	Yes	Riparian Management	Yes – Migratory Bird
White-winged Scoter	<i>Melanitta fusca</i>	SC (2010)	Sensitive	-	-	Yes	Riparian Management	Yes – Migratory Bird
FISH								
Arctic Grayling - Northern Beringean lineage	<i>Thymallus arcticus</i> - Northern Beringean lineage	SC (2010)	Sensitive	Candidate (2014)	-	N/A	Bull Trout and Arctic Grayling Fish Risk	Yes
Bull Trout	<i>Salvelinus confluentus</i>	T (2014)	Sensitive	SC (2012)	-	N/A	Bull Trout and Arctic Grayling Fish Risk	Yes
Northern Redbelly Dace	<i>Chrosomus eos</i>	-	Sensitive	-	-	N/A	Riparian Management	No
Pearl Dace	<i>Margariscus nachtriebi</i>	-	-	-	-	N/A	Riparian Management	No
MAMMALS								
Caribou (woodland subspecies)	<i>Rangifer tarandus caribou</i>	T (2010)	At Risk	T (2002)	1-T (2003)	N/A	Caribou	Yes
Fisher	<i>Martes pennanti</i>	-	Sensitive	-	-	N/A	Riparian Management	No
Grizzly Bear (western population)	<i>Ursus arctos</i>	T (2010)	At Risk	SC (2012)	-	N/A	Patch Size	Yes
Northern Myotis	<i>Myotis septentrionalis</i>	-	-	E (2013)	-	N/A	Structural Retention	No
Wolverine, <i>Iucus</i> subspecies	<i>Gulo gulo luscus</i>	-	May Be At Risk	SC (2003)	-	N/A	Representation of Plant Communities at the Landscape Level	No
INVERTEBRATES								
Umbilicate Sprite	<i>Promenetus umbilicatellus</i>	-	Sensitive	-	-	N/A	Representation of Plant Communities at the Landscape Level	No
Thicklip Rams-horn	<i>Planorbula armigera</i>	-	Sensitive	-	-	N/A	Representation of Plant Communities at the Landscape Level	No
Threeridge Valvata	<i>Valvata tricarinata</i>	-	Sensitive	-	-	N/A	Representation of Plant Communities at the Landscape Level	No

7.4.1 SPECIES-SPECIFIC STRATEGIES

7.4.1.1 Migratory Birds

In Canada, the Migratory Birds Convention Act (MBCA) of 1994 and associated Migratory Birds Regulations (MBR) established the legal framework and objectives for the protection and conservation of migratory birds. The two main outcomes of this legislation were: 1) strategic conservation actions to address declining populations of many bird species; and 2) legal provisions for the protection of migratory birds.

To develop strategic conservation plans and actions, the North American Bird Conservation Initiative (NABCI) was formed in 1999 between Canada, the US, and Mexico. As a result of this initiative, 12 Bird Conservation Regions (BCRs) were established across Canada based on similar ecological parameters relevant to birds. Each BCR has an associated Strategy that provides landscape-level direction for different elements of migratory bird conservation, including priority bird species and habitat associations.

Under the MBR, it is illegal to destroy the nests or eggs of a migratory bird in Canada. Inadvertent destruction of nests or eggs during activities such as forestry is called 'incidental take'. Currently, the regulations do not provide for a permit or exemption for the incidental take in the course of industrial or other activities (forestry, mining, agriculture, development, etc.). Violations of the MBR, regardless of the scale of a given activity, the level of potential impacts on bird populations, or the nature of mitigation measures taken, can result in prosecutions. However, if an alleged violation of the MBR were prosecuted due to incidental take, it would always be open to the accused to raise the defense of due diligence. In Canada, the agency responsible for overseeing and enforcing the MBR is Environment Canada (EC).

Rationale/Approach

This strategy and standard work procedure serves as a management plan for all migratory bird species for Canfor's operations in British Columbia and Alberta.

To reflect differences in broad forest cover types and breeding migratory bird assemblies across a wide area, Canfor's western Canadian operating area was split into three areas: North-Central British Columbia (NCBC), Southern British Columbia (SBC), and Peace and Alberta (PAB). These groupings also conform to the geographical boundaries in the BCRs (details regarding the Peace and Alberta are listed below).

Within each area, a list of all migratory bird species occurring was compiled. From this list, species were removed if: 1) they did not breed within Canfor's operating areas; or 2) were assessed as adequately managed under Canfor's other strategies (e.g., Western Grebe would be covered under riparian management strategies). The remaining species were considered focal species for an area. Migratory bird species listed in Table 43, however, are only a subset of migratory bird species that are also SoMC in the Grande Prairie DFA.

Canfor – Peace and Alberta

Canfor's operations in the Peace region of northern British Columbia and Alberta include the Fort Nelson and Peace Forest Districts in British Columbia and Forest Management Agreement (FMA) area 9900037. These areas collectively fall within BCR Region 6 – Boreal Taiga Plains (Environment Canada, 2013). A total of 153 migratory bird species occur in the Grande Prairie FMA area and of these, 29 are defined as SoMC (Table 43).

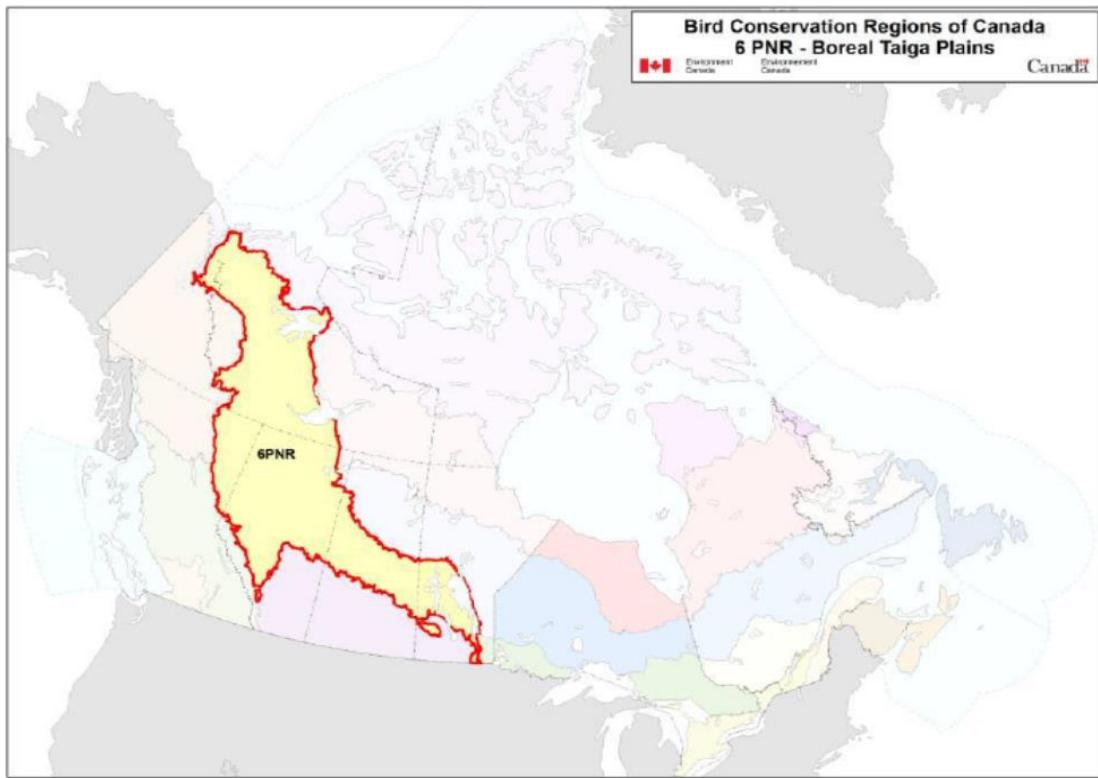


Figure 70 Boundaries of Environment Canada Bird Conservation Region
Map Source: (Environment Canada, 2013)

To support the conservation goals in the MBCA, Environment Canada (2015b) has provided general advice on the prevention of detrimental effects on migratory birds, their eggs and nests, which is summarized below. In general, EC currently recommends:

1. to avoid engaging in potentially destructive activities during key periods in order to reduce the risk of nest destruction; and
2. to develop and implement a management plan that includes appropriate preventive measures to minimize the risk of impacts, and to mitigate any unavoidable impacts on nests.

Key periods for migratory birds are generally the period surrounding breeding activity (e.g., courtship, mating, egg laying), although migration, moulting, and feeding are other activities where breeding birds could be impacted by forestry operations. Within each BCR, EC has developed nesting calendars (Figure

- 2) to allow an assessment of the potential risk to breeding species from activity within the breeding season.

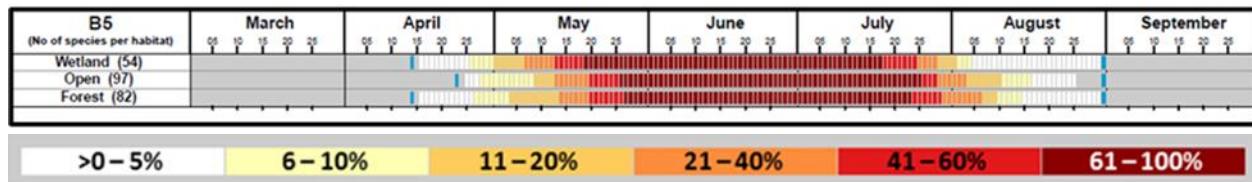


Figure 71 Nesting Calendar for Migratory Birds Breeding in Zone B-5 in Bird Conservation Region 6-Boreal Taiga Plains
Colours and percentages refer to “proportion of species predicted to be actively nesting on a given date” (Environment Canada, 2015b)

Several factors can influence the risk of impacts by forestry operations on migratory birds, including:

1. Habitat type: species occurring in habitats outside of the direct footprint (e.g., wetlands) range of forestry activities will be less or not impacted by standard forestry practices. In contrast, species occurring in stand types and/or age classes targeted by forestry practices will be potentially more highly impacted;
2. Habitat searchability: some habitats are simpler and thus easier to search for and find nests of migratory species than more complex habitats (e.g., open grassland vs. riparian shrub land); and
3. Nest type: some species have large, conspicuous nests (e.g., Great Blue Heron rookeries) while many other species have small, inconspicuous nests (e.g., Brown Creeper).

7.4.1.1.1 Mitigation Strategies

Canfor has identified mitigation strategies and best management practices that can be planned and implemented to reduce the risk to migratory birds in Canfor’s FMA area during the breeding period. Best management practices in high and very high risk stands may include, but are not limited to:

1. Avoid felling of stands (any stand type) between May 1st and July 30th to the degree practicable. This may involve felling, skidding, and decking at landings/roadside during winter for hauling or chipping in summer, scheduling stands to avoid harvesting in spring/summer, and/or carrying higher inventory in winter just before break-up.
2. Stands within blocks that are scheduled to be harvested between May 1st and July 30th will be categorized by their relative risk. Risk will be defined in terms of the density of migratory birds nesting in forested stands that are considered to be endangered, threatened or special concern (by either COSEWIC, or on the Alberta listed species). Priority species for Bird Conservation 6 region, as defined in the Partners in Flights North American Landbird Conservation Program will also be considered. Information for this categorization will come from local studies and the density/habitat associations from the Boreal Avian Modelling Project.

Until this information is compiled, the table below provides a preliminary risk rating that will be used.

Table 44 Migratory Bird Risk Rating

Stand Type	Yield Group	Stand Age	Risk for Presence of Listed Migratory Bird Species
Deciduous leading (>75% deciduous species)	Nat-1, Nat-2, Nat-4, Nat-7	>140 yrs	Very High
		100-140 yrs	High
		80-100 yrs	Moderate
		60-80 yrs	Low
Mixedwood (stands with percent conifer between 25-75% and deciduous >25%)	Nat-3, Nat-6, Nat-9, Nat-17	>140 yrs	Very High
		100-140 yrs	High
		80-100 yrs	Moderate
		60-80 yrs	Low
Spruce (>75% spruce or spruce leading mixed conifer stands with <25% deciduous)	Nat-5, Nat-11, Nat-15, Nat-16	>120 yrs	High
		100-120 yrs	Moderate
		80-100 yrs	Low
		60-80 yrs	Low
Pine (>75% jack or lodgepole pine)	Nat-8, Nat-10, Nat-14, Nat-12	>140 yrs	Moderate
		100-140 yrs	Moderate
		80-100 yrs	Low
		60-80 yrs	Low

3. Stands rated as very high or high risk will either not be harvested between May 1st and July 30th, will be surveyed for the presence of threatened and endangered migratory birds prior to harvest, or, as a last resort, if the first two options are not practicable, will have mitigative measures applied to the stand (see Point 6). Regardless of mitigative factors, no more than 10 % of the total annual harvest shall be conducted between May 1st and July 30th in stands rated high or very high.
4. Of the stands rated low to moderate, the low stands blocks will be scheduled first and the moderate ones scheduled later in the season, preferably after July 30th, to the degree practicable. Environment Canada is developing a program called 'R-Nest' which will allow more accurate determination of dates in the future.
5. Layout crews, and any feller buncher operators and foreman who will be logging a block in spring will be trained to identify stick nests and active migratory bird nests in general, and to inform their Canfor supervisor if they detect one of these during layout or operations. The

supervisor will develop a plan to protect the nest. In no instance is a tree containing a known active migratory bird nest to be felled.

6. Mitigative measures to be applied to high and very high risk stands must include at least two of the following, to be incorporated into site plans:
 - a. Retention of live trees within the stand (minimum 15/ha, > 17.5 cm dbh);
 - b. Retention of standing dead trees (not stubs) within the stand (3/ha > 23 cm dbh);
 - c. Retention of riparian habitat (hygric and sub-hygric sites), particularly with older hardwood or mixedwood stands on them, within riparian reserves;
 - d. Retention of wildlife tree patches or other reserves within the block- all at least .25ha in size, with some > 2ha and for blocks > 100 ha, > 5 ha- focused around important habitat features like snags, large old trees, mixedwood areas;
 - e. Retention of a representative portion of the stand at least 2ha in size outside the net harvested area of the block (either as wildlife tree patch, or other reserve, so it will not be harvested in the future); and
 - f. Planning silviculture and stand-tending practices with the goal of producing mature mixedwood stands on sites currently supporting mixedwood stands.
7. Canfor has numerous stand and landscape level management practices which conserve migratory bird habitat over large spatial and temporal scales, including the retention of stand structure, riparian reserves, wildlife tree patches, old growth management areas, inoperable areas, etc. Canfor will compile or initiate wildlife habitat and forest modeling to provide estimates of changes in the amount of various habitat types through time (as per the species accounting system).

7.4.1.2 Barred Owl

Barred owls (*Strix varia*) are listed as Sensitive in the *General Status of Alberta Wild Species* report. They are large owls that nest in tree cavities, typically very old hardwood trees, or standing snags and are widely distributed throughout Alberta.

The requirement of old mixedwood habitat and the large size of their home range also make barred owl a suitable indicator for other old mixedwood associates (Mazur, James, & Frith, 1997). By maintaining enough suitable habitat for a barred owl pair to exist it is likely that many other species (i.e.: bats, wolverines, squirrels, wood peckers, fisher, migratory birds, etc.) that require this habitat on a smaller scale will also benefit. This coarse filter approach to ecosystem management, works on the assumption that if suitable habitat is available, the species associated with that habitat will be able to thrive. The management choices will ensure that habitat types available prior to operations will remain available through time.



Figure 72 Barred Owl

Preferred barred owl habitat is old mixedwood forest; a habitat type that could be impacted by forest operations over the long term. The amount of barred owl habitat at any given time in the planning horizon is an indicator of the effectiveness of the Forest Management Plan in maintaining that specific habitat type. AESRD has developed an Alberta Vegetation Inventory based Barred Owl Habitat Model to estimate the spatial extent of potential barred owl breeding territories on the landscape (Russell, 2008). Canfor has built AESRD's Barred Owl Habitat Model into the timber supply model to identify and minimize the potential impacts of the spatial harvest sequence throughout the 200-year planning horizon.

The model generates resource selection function (RSF) values for barred owl habitat. The calculation of RSF in the model is based upon a number of factors that include presence/absence of hardwood and softwood forest and the age of these forest stands. Stands with an RSF value of 0.17054 or higher are deemed to be suitable barred owl habitat. In addition to this value selection, raster cells are compiled into 500ha units to ensure that sufficient area of suitable habitat exists within a particular area. To generate the units the average value of the RSF is calculated from the model's raster grids. Figure 73 shows the current RSF values for barred owl habitat within Canfor's FMA area and Figure 74 demonstrates the current status of barred owl potential territories based on habitat from the model's raster grids.

Indicator 1.2.2c) from Canfor's *2012 Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure that the current level of barred owl breeding habitat is maintained across the FMA area.

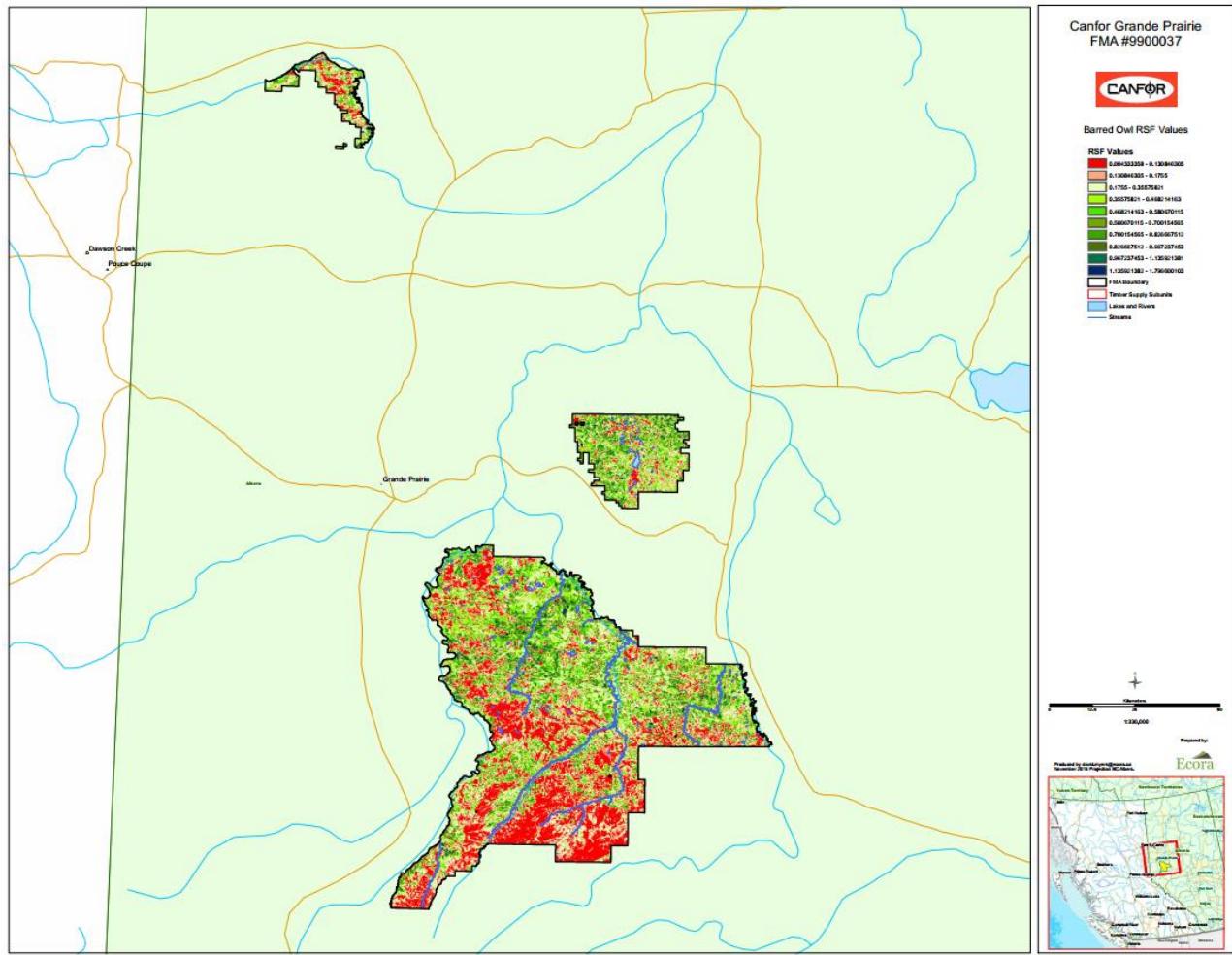


Figure 73 Canfor FMA Area Barred Owl RSF Values

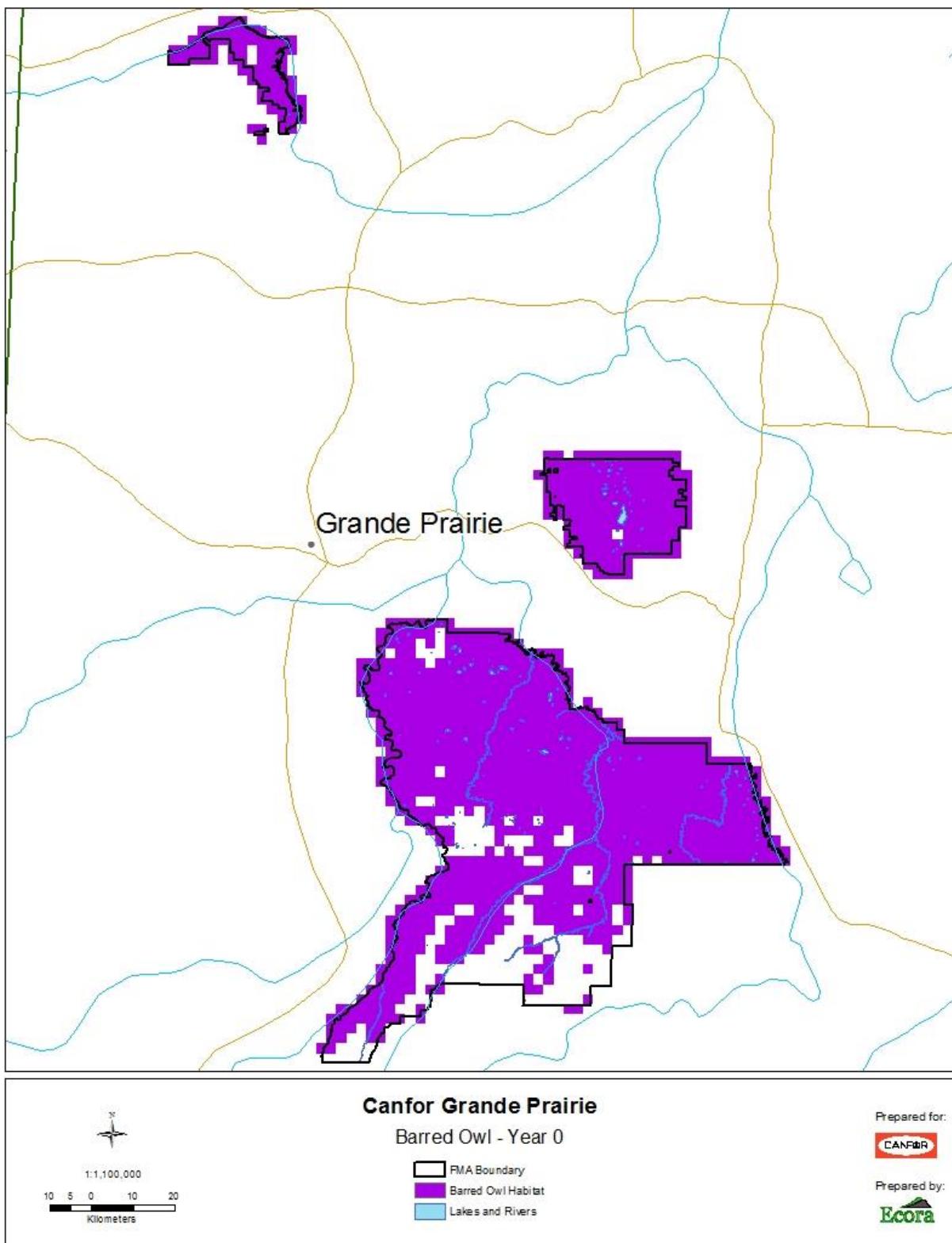


Figure 74 Current Status of Barred Owl Potential Territories Based on Habitat

7.4.1.3 Trumpeter Swans

Trumpeter swans once ranged widely across North America. However, by the early 1900s, a combination of habitat destruction and hunting extirpated the species from much of its range. In recent decades, through active management and restoration efforts, trumpeter swan populations have regained some of their former abundance and distribution. (Smith, 2013).

Until 2014, trumpeter swans were listed as Threatened under the Wildlife Act. Due to effective management practices and increasing populations, the species was down listed in 2014 to a Species of Special Concern on the Alberta Species at Risk list.

There are three recognized populations of swans. In Alberta, trumpeter swans are known as the Rocky Mountain Population.

Trumpeter swans are migratory waterfowl and are found in Alberta during the spring, summer and fall. However, they are not long distance travelers and fly only far enough to reach suitable habitats for nesting or wintering. Any swan nesting in Alberta or seen here between late May and late August is probably a trumpeter swan. The birds arrive in Alberta in April and move north as the lakes and sloughs open in the spring. The swans require shallow lakes with an abundant supply of aquatic plants, insects, and snails (for nest sites and food) and a low level of human disturbance. The water must be a constant level throughout the summer and have little wave action or currents.

Fall migration starts at freeze-up in late October or November. The swans again gather in the staging areas, then fly south until they reach an area of shallow lakes and streams with food and open water. In the early winter, most birds from Grande Prairie stay on the Yellowstone Lake in Yellowstone National Park.

Trumpeter swans now occur throughout the province, but are most abundant in the vicinity of Grande Prairie.

“Despite the population increases, the trumpeter swan is still among the rarest waterfowl in North America. At least in northern portions of Alberta range, availability of breeding habitat does not appear to be a limiting factor. However, the species’ sensitivity to disturbance means that it continues to benefit from land-use standards and guidelines where breeding and human activities coincide” (Smith, 2013).

7.4.1.3.1 Management Strategies

Swans usually use the same nesting sites year after year, so AESRD Fish and Wildlife conduct regular surveys to identify trumpeter swan water bodies within the Peace Region. When breeding pairs and nests are found on water bodies they are entered into a Provincial database. In 2000, there were 45 trumpeter swan nesting sites identified on Canfor’s FMA area (Canfor, 2003). An additional 47 sites were



Figure 75 Trumpeter Swan and Cygnets

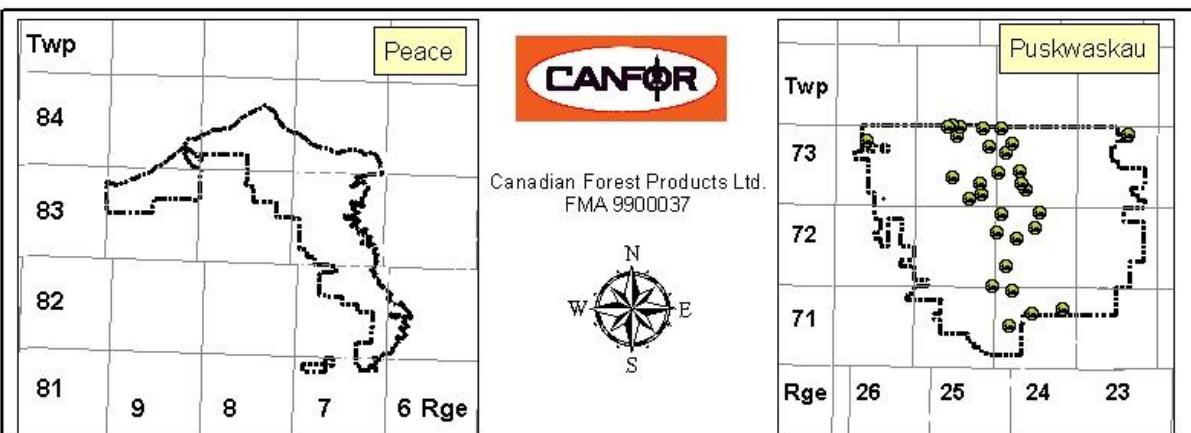
Photo Source:

<http://natureray.com/trumpeter%20swan%20and%20cygnets.jpg>



identified by 2014, which totals 92 nesting sites identified and mapped on Canfor's FMA area (Figure 76). Since there is no timber harvesting allowed within 200m of identified trumpeter swan lakes or waterbodies, Canfor has removed these areas from the timber harvesting landbase used in the 2015 timber supply analysis.

Canfor's *Operating Ground Rules* (Canfor, 2011b) also has specific timing restrictions for forestry operations when working adjacent to trumpeter swan nesting sites and water bodies. Canfor will continue to adhere to these ground rules and has committed to monitoring and reporting performance in preserving trumpeter swan habitat in Canfor VOIT 1.2.1a) (See Section 9 for correlation with Annex 4).



Trumpeter Swan Sites

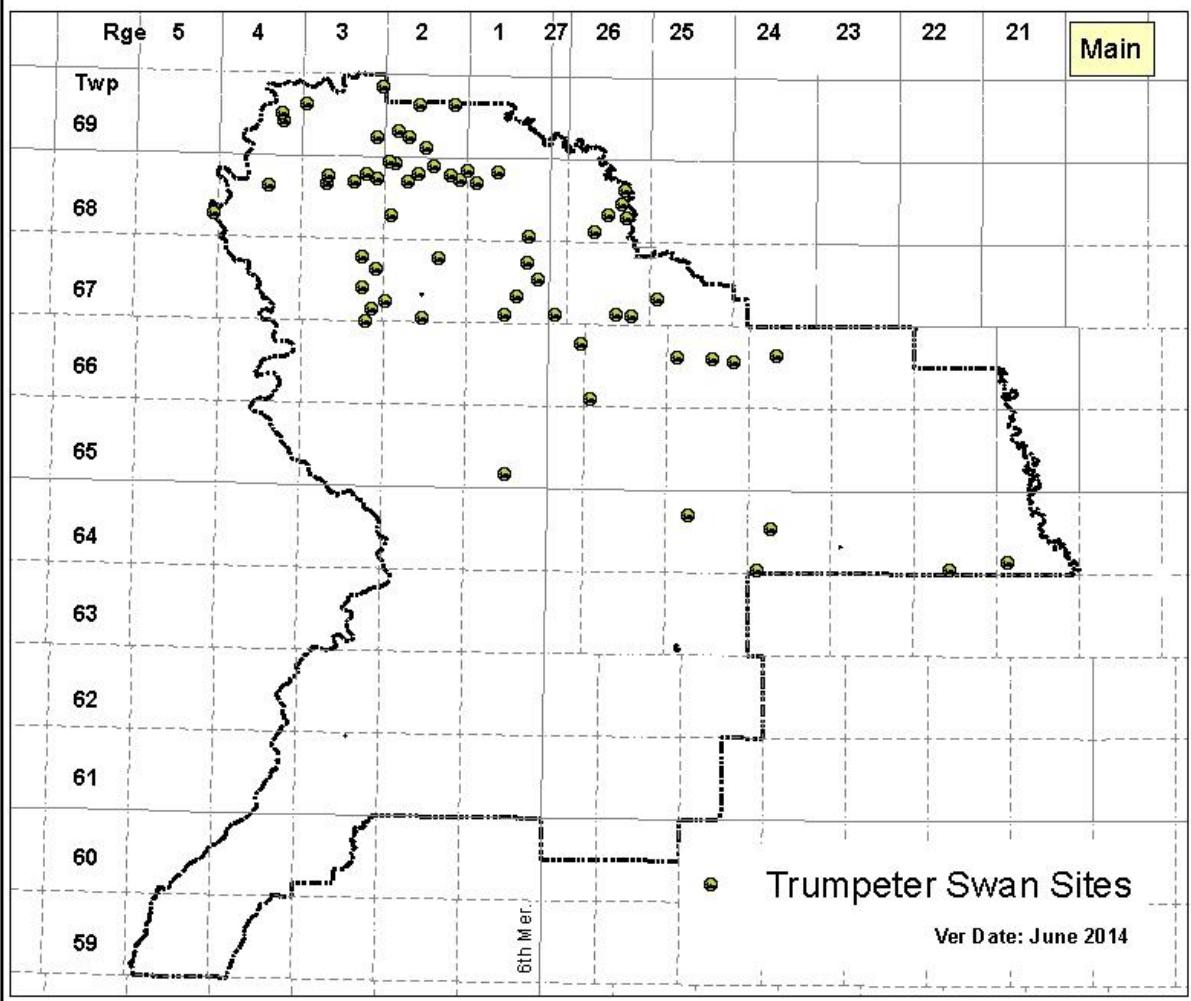


Figure 76 Trumpeter Swan Sites

7.4.1.4 Fish

7.4.1.4.1 Bull Trout

Bull trout (*Salvelinus confluentus*) is the Provincial Fish of Alberta and is listed under Alberta's Wildlife Act as Threatened and Species of Special Concern under COSEWIC since 2012. Harvest of bull trout in Alberta has been prohibited since 1995 as a result of province wide declines in population density and distribution. Currently the sport fishing regulations only support the practice of catch and release. Bull trout are still present in all of the major watersheds on the eastern slopes of Alberta, but populations are continually declining particularly in the southern watersheds. Although below historic levels, bull trout populations are higher in the Peace and Smoky watersheds which are linked to Canfor's FMA area. It is estimated that bull trout habitat has decreased approximately 33% from historic levels across Alberta due to an increase in fragmentation (AESRD, 2012), overharvesting, competition from introduced species, very specific habitat requirements, increased summer temperatures, and unusual weather events (floods and droughts).



Figure 77 Bull Trout

Photo Source: A. Meinke, AESRD Fisheries Biologist

Bull trout are a cold-water species that generally prefer maximum water temperatures of 12-13 degrees Celsius. It has been noted that when water temperatures reach or exceed 15 degrees Celsius that bull trout presence is very uncommon or absent (AESRD, 2012). Bull trout's dependency on clean, cold water and need for thermal refuge within specific temperature ranges makes it highly sensitive to any type of disturbance. Most bull trout in eastern slopes reside in major rivers and streams and move into smaller tributaries to spawn and rear as juveniles. Bull trout often migrate long distances to reach spawning, rearing, and over-wintering sites and require unimpeded access across large areas of a watershed(s) in order to fulfill life stages essential for survival and reproduction. In the summer, bull trout seek out deep cool pools that provide thermal refuge. In the winter, bull trout prefer sites that will not develop frazil ice and will often overwinter in the same sites year after year (AESRD, 2012).

The maintenance and availability of spawning habitat is essential for the maintenance of bull trout populations. Bull trout spawn in the fall when water temperatures are cool and dig redds in coarse gravel sites with low levels of sediments to incubate the eggs. They tend to spawn in smaller, slow moving streams within proximity to cover (cut banks, overhanging bush) usually close to pools where ground upwelling of cold water prevents the stream from completely freezing and provides suitable water temperatures for embryo development. This is a critical component to bull trout spawning habitat because the eggs incubate over winter. Bull trout generally return to the same spawning habitat year after year.

The reliance of bull trout to be able to move between habitats to find food, locate habitat of suitable temperatures, avoid sedimentation, and find ideal spawning sites makes them highly susceptible to the

impacts of stream fragmentation due to road construction and improper crossings (i.e.: hanging culverts as a result of improperly sized culverts) (AESRD, 2005). Due to the extremely specific needs for bull trout spawning habitat, some of these known sites are designated as “Class A” waterbodies¹⁵ under the *Alberta Water Act*. Work adjacent to and or within Class A streams is restricted under the *Water Act, Codes of Practice for Watercourse Crossings* (AESRD, 2012).

7.4.1.4.2 Arctic Grayling

Arctic grayling (*Thymallus arcticus*) is listed as a Species of Special Concern under Alberta’s Wildlife Act since 2010 and a Candidate Species of Concern under COSEWIC in 2014. In 2015 provincial sport fishing regulations were changed to prohibit harvest of Arctic grayling and now only support catch and release practices, as a result of provincial scale declines in population density and distribution.

Arctic grayling prefer cool clean waters and are generally found in the Boreal and Foothills Natural Regions including the Peace River basin which encompasses

Canfor’s FMA area (AESRD, 2005). Grayling are not likely to occur in tributaries that contain high levels of sediment and prefer areas with minimal temperature fluctuations. Grayling tend to move downstream to deeper overwintering pools to avoid anchor ice and can move up to 100km in their migrations (AESRD, 2005). In early spring, Arctic grayling move upstream to spawn in small cool tributaries. Unlike bull trout that dig redds for their eggs, Arctic grayling broadcast spawn and the eggs incubate in the loose gravel bed of the stream, which makes the eggs more susceptible to disturbance in variable spring conditions (AESRD, 2005).

The reliance of Arctic grayling to be able to move between habitats to find food, locate habitat of suitable temperatures, avoid sedimentation, and find ideal spawning sites makes them highly susceptible to the impacts of stream fragmentation due to road construction and improper crossings (i.e.: hanging culverts) (AESRD, 2005). ESRD’s Status of the Arctic Grayling Report states that: “A range of factors, acting in a cumulative fashion, have most likely led to the decline of many grayling populations, including high angling catchability coupled with popular sport fishery, habitat fragmentation caused by improper culverts, and increases in water temperature as a result of changing climate and land-use practices” (AESRD, 2005).



Figure 78 Arctic Grayling

¹⁵ Class “A” Waterbodies-Known habitats critical to the continued viability of locally or regionally important fish species; Habitat areas are sensitive enough to be damaged by any type of in-stream activity or changes to water quality or flow regime. Fish and fish habitat affected by sediment load, turbidity, disposition of sediment, chemical contamination, or alteration of stream flow (Canfor, 2011b).

Presence of Bull Trout and Arctic Grayling on Canfor's FMA Area

Figure 79 shows the tributaries on Canfor's FMA area likely to have bull trout and Arctic grayling. Tributaries that aren't highlighted for bull trout and Arctic grayling presence may contain the species, but none were found at the time of sampling or have not been sampled.

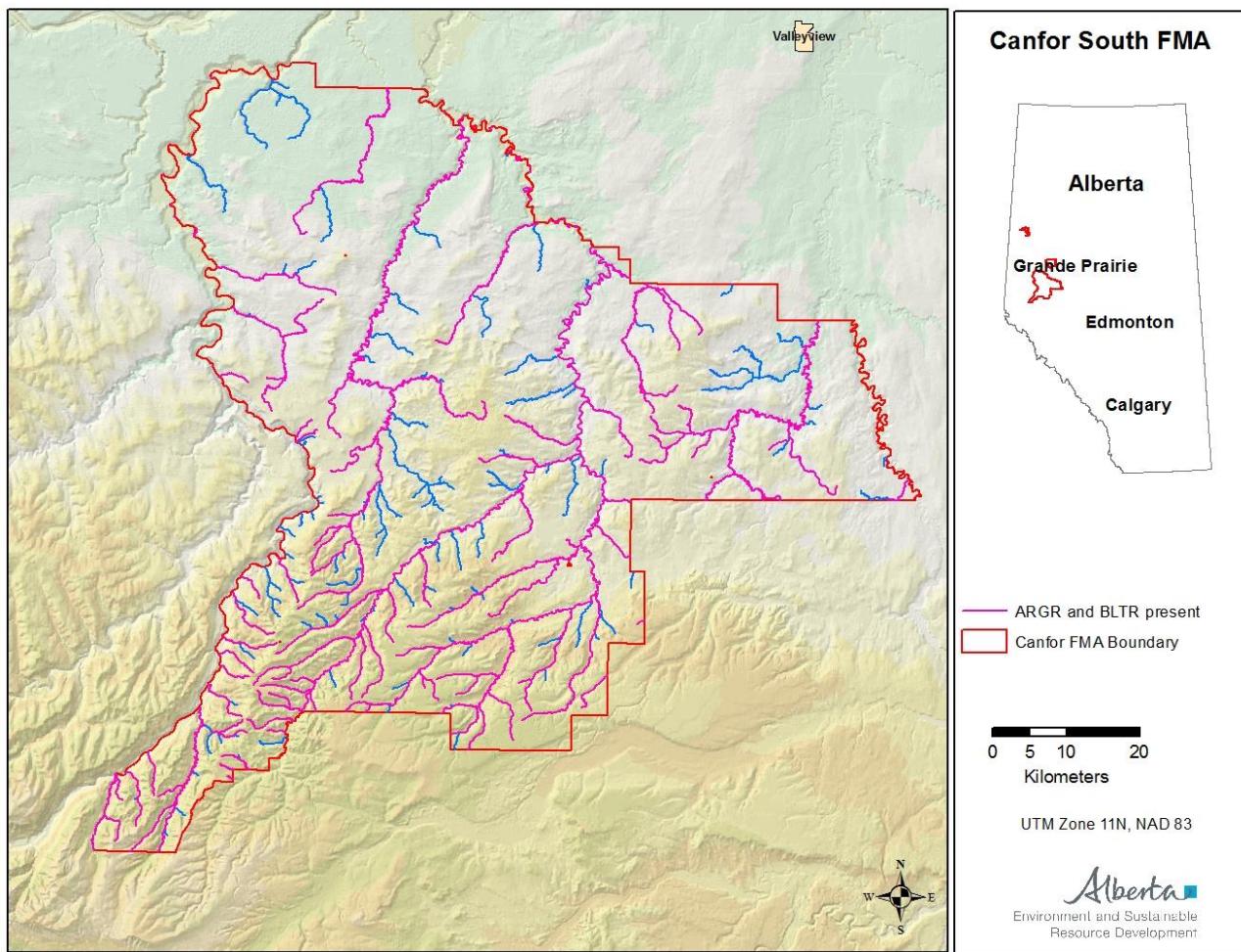


Figure 79 Presence of Bull Trout and Arctic Grayling on Canfor's FMA Area
Map Source: (Meinke, 2014)

7.4.1.4.3 Management Strategies

Risk to fish populations and communities is a key consideration for developing and directing strategies to conserve and manage fish resources. Many factors contribute to risk, including alteration to fish habitat and exploitation of fish. Development of forested landscapes requires the development of roads. Roads and stream crossings cumulatively increase habitat fragmentation, sedimentation of habitats, and access for exploitation. Bull trout and Arctic grayling habitat is not only impacted by Canfor Alberta's roads, but also roads constructed by other industrial users. It has been recommended by AESRD Fisheries Management to use road density in conjunction with Environment and Sustainable Resource Development's "Conceptual Approach to Fish Risk" (Figure 80) as a metric to describe the

cumulative risk to Bull Trout and Arctic Grayling and their habitats. Although this target specifically speaks to the influence of roads and habitat fragmentation, it must also be noted that Canfor's Watershed Management Strategies (Section 7.3) also directly relate to reducing risk to fish and maintaining fish habitat on the FMA area.

Through monitoring fish risk using road densities, Canfor and government will be able to identify higher risk watersheds and collaboratively work together to determine types of mitigation strategies that will reduce the risk to bull trout and Arctic grayling fish populations.

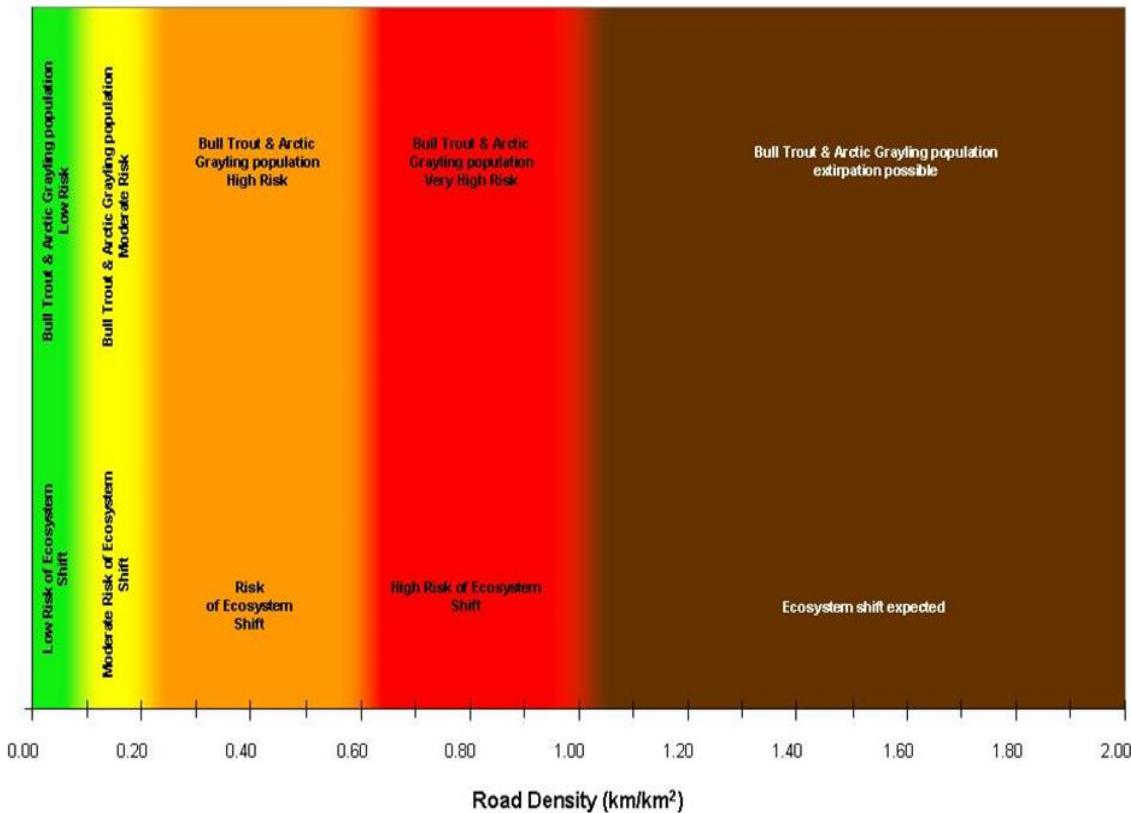


Figure 80 Conceptual Approach to Fish Risk

Canfor has been working with AESRD's fisheries biologist to develop a management strategy that is implementable and measureable. In consultation with AESRD, Canfor has created Canfor's Fish Risk Flow Chart (Figure 82). This chart is used to help prioritize watersheds and crossings for the scheduling and implementation of mitigation strategies based on risk to fish.

Indicator 1.2.2b) from Canfor's 2012 *Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure monitoring and reporting of the successful implementation of this strategy.

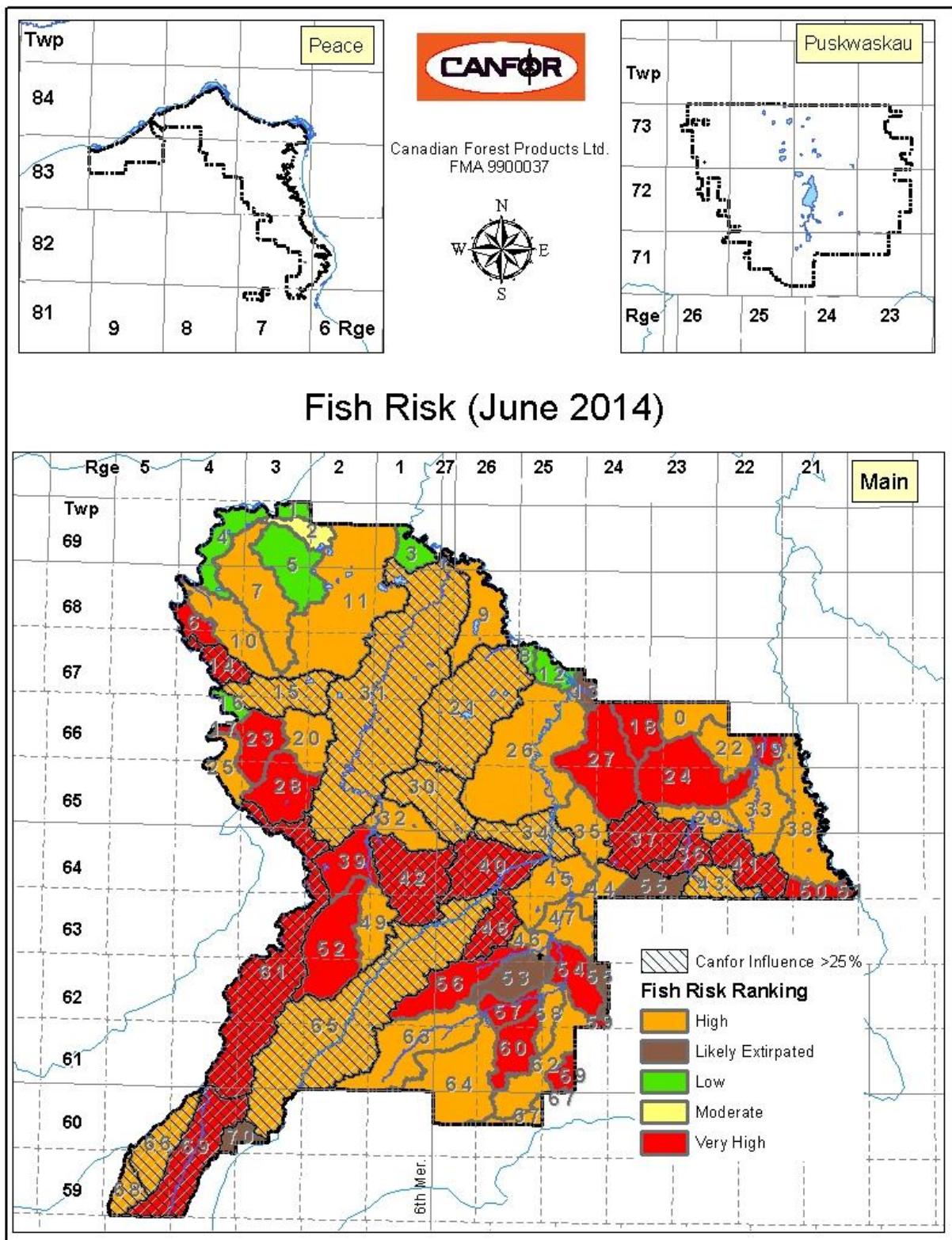


Figure 81 Fish Risk

Canfor's Fish Risk Flow Chart

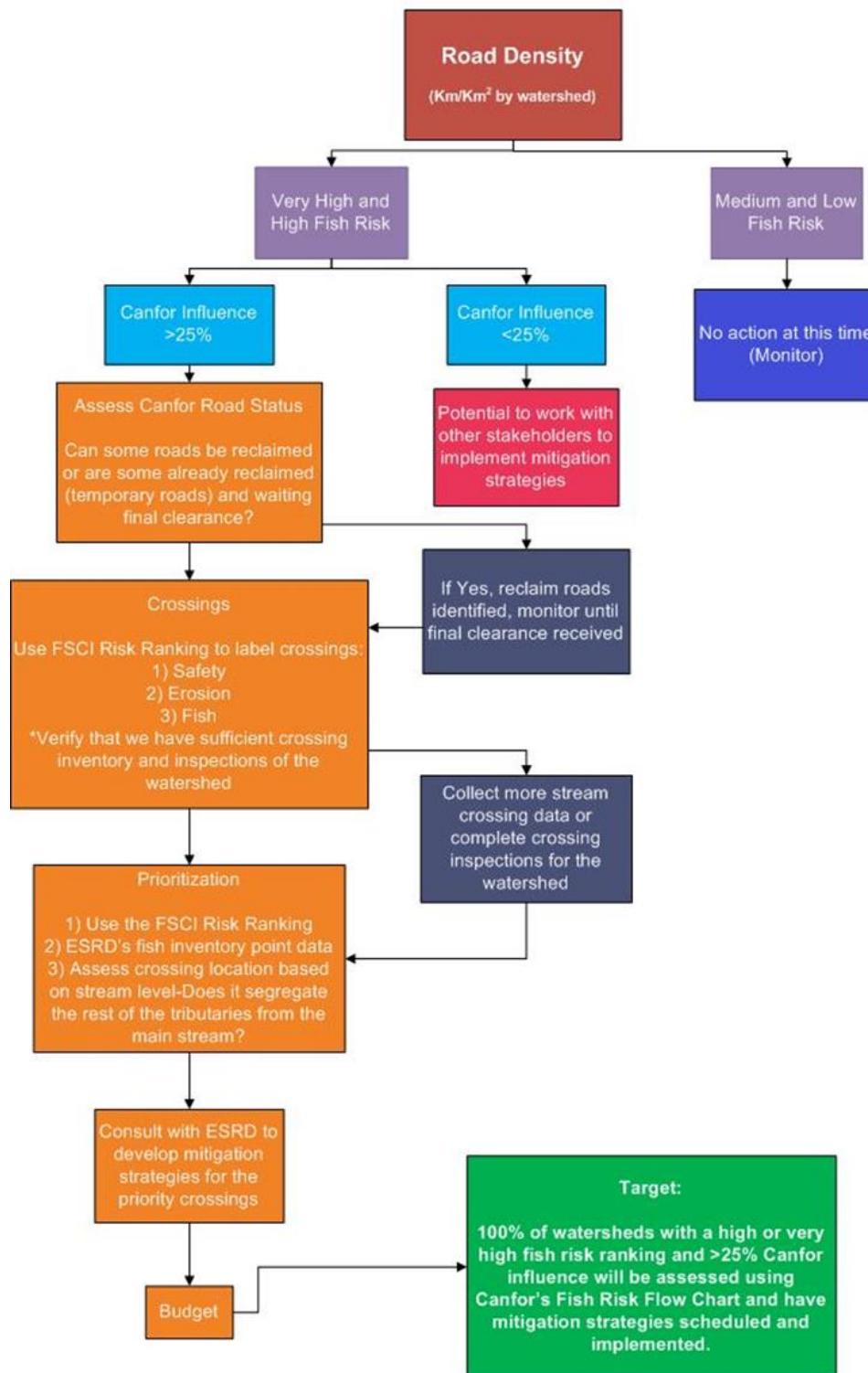


Figure 82 Canfor's Fish Risk Flow Chart

Canfor Alberta's current road layer will be updated with new License of Occupation roads, Department License of Occupations roads, and temporary roads used for extraction of timber annually. All temporary roads that have received a block final clearance or that are known to have been deactivated permanently will be removed. The road density from this calculation will determine the fish risk ranking based on Environment and Sustainable Resource Development's "Conceptual Approach to Fish Risk".

7.4.1.4.3.1 Mitigation Strategies

Bull Trout and Arctic Grayling are temperature dependent species; therefore it is essential to ensure that Canfor's activities are not increasing water turbidity, sedimentation and the water temperature of over land flows, which ultimately lead to increased water temperatures. Canfor and AESRD have identified mitigation strategies and best management practices that can be planned and implemented in the high and very high risk watersheds to reduce the risk to Bull Trout and Arctic Grayling on Canfor's FMA area. Mitigation strategies in high and very high risk watersheds may include, but are not limited to:

- Minimize the construction of new permanent roads and crossings and avoid wet areas utilizing LiDAR and Wet Areas Mapping;
- Minimize the construction of new temporary roads and crossings and avoid wet areas utilizing LiDAR and Wet Areas Mapping;
- On streams that are considered fish bearing (intermittent, small perms and larger) and located in watersheds deemed as high risk, install crossings that do not alter the natural stream bed or restrict flow (design for a 1:50 at minimum). In streams that are not considered fish bearing ephemerals, install crossings that are designed to not restrict larger anticipated flows;
- Ensure all road construction and crossing installations are completed to a high quality and include prompt sedimentation control measures and robust sedimentation control measures;
- Identify the length of time temporary roads are going to be open and pre-plan the appropriate crossing for that length of time;
- Enhance Canfor's stream crossing inventory and monitoring program through increased inspections and monitoring of crossings in very high and high risk watersheds;
- Focus inspections and remediation in higher risk watersheds. The objective is to install new crossings that do not alter the natural stream bed or restrict flow and remediate all old crossings to the same standard over the long term;
- Promptly schedule all crossings identified as high priority based on the Foothill's Stream Crossing Inspection (FSCI) Program and Canfor's Fish Risk Flow Chart for appropriate and timely maintenance;
- Ensure all temporary stream crossings such as log fills and log bridges are removed prior to spring break-up to allow unimpeded flow and reduce the probability of sediment inputs;
- Ensure extreme operator diligence when removing temporary crossings to prevent stream and habitat degradation;
- Promptly reclaim all temporary access and in-block roads when no longer needed. All reclamation must be completed to the highest possible standard to reduce the risk of sedimentation;

- In areas that Canfor has a small influence due to other stakeholders owning and developing a majority of the access, Canfor may initiate discussions to work with the other stakeholders to implement mitigation strategies; and
- Initiate integrated land management and shared access plans in areas where other stakeholders may be operating or have existing road infrastructure.

7.4.1.5 Woodland Caribou

Boreal woodland caribou (*Rangifer tarandus caribou*) are located broadly throughout Boreal forests across Canada and are listed as threatened under Canada's *Species at Risk Act* (SARA). There are 51 woodland caribou ranges in Canada as identified in the Federal Government's boreal caribou strategy (Environment Canada, 2012). Of the 51 woodland caribou ranges in Canada there are 12 woodland caribou ranges in Alberta. Alberta has designated the woodland caribou as threatened under Alberta's *Wildlife Act*.



Figure 83 Little Smoky Caribou

The distribution of woodland caribou in west-central

Alberta has declined over the last 50 to 80 years (Soper, 1970) (Alberta Fish and Wildlife Division, unpub. data). The Little Smoky caribou population is now the last boreal ecotype woodland caribou population remaining in west-central Alberta, and the most southerly boreal population remaining in the province. The A La Peche caribou population is now the most southerly mountain caribou population remaining in Alberta on provincially controlled lands. In the Little Smoky and A La Peche Caribou Ranges the occurrence of caribou has been monitored for 32 years (1981-2013) while caribou vital rates have been monitored for 15 years (1998/99 – 2012/13) (Hervieux, et al., 2013).

Prior to the initiation of the annual wolf population reduction program in 2005/06, the Little Smoky caribou population was estimated to be in a state of population decline due to moderate to high levels of annual adult female caribou mortality and very low levels of annual calf survival – the population was described as being on a path to extirpation (Alberta Caribou Recovery Team, 2005). However, the Little Smoky caribou population has been estimated to be stable or slightly increasing since the wolf management program was initiated (Hervieux, Hebblewhite, Stepnisky, Bacon, & Boutin, 2014).

The A La Peche caribou population demonstrated approximate population stability during the first years of populations monitoring, however, in recent years the A La Peche population has begun to decline. The wolf population reduction program directed at the adjacent Little Smoky Caribou Range may be contributing to mitigating the extent of the A La Peche caribou population decline (Hervieux, et al., 2013).

The current estimated population size for Little Smoky herd is between 60 and 100 caribou and the A La Peche herd is between 80 and 150 caribou. The annual adult female population growth rates (λ)

are depicted in Figure 84 & Figure 85. Lambda values of 1.0 indicate population stability. Values greater than 1.0 indicate population growth and values less than 1.0 indicate population decline.

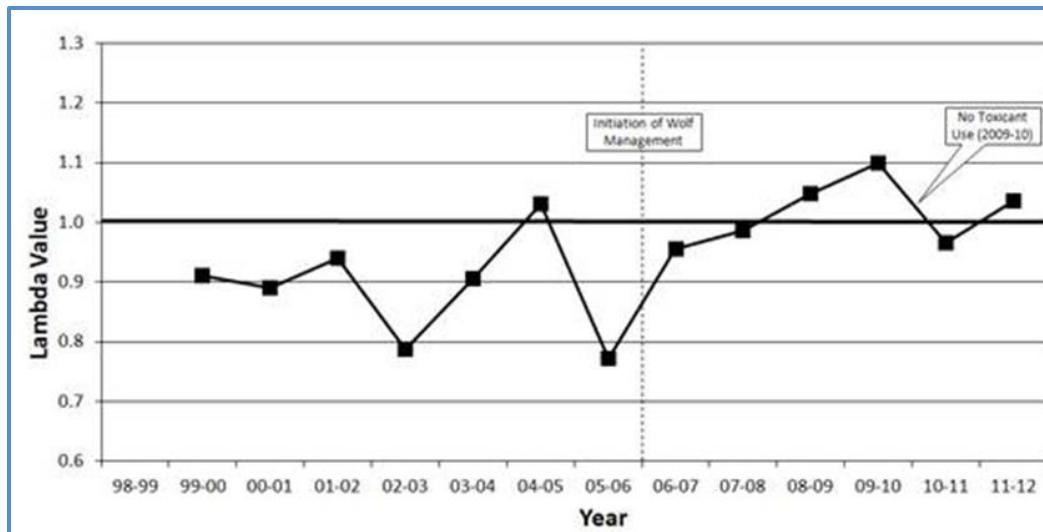


Figure 84 Annual Adult Female Population Growth Rate (Lambda) in the Little Smoky Caribou Herd

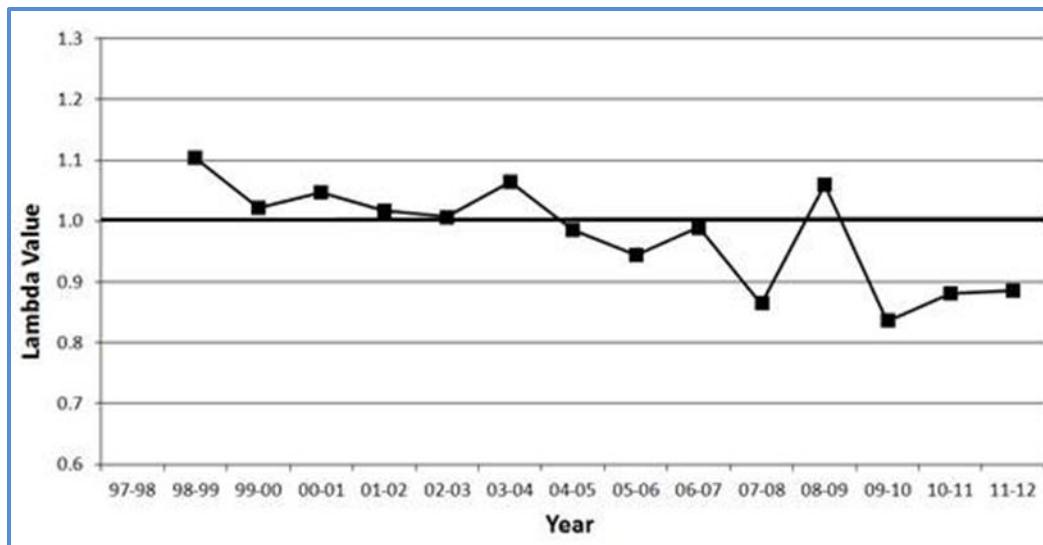


Figure 85 Annual Adult Female Population Growth Rate (Lambda) in the A La Peche Caribou Herd

Values were calculated using annual estimates of adult female survival and calf recruitment¹⁶. Survival values were derived annually from a radio-collared sample of adult female caribou between May 1st and

¹⁶ Survival estimates were calculated using Pollock et al.'s (1989) staggered-entry modification of Kaplan and Meier's survivorship model (1958). See Pollock, K. H., S. R. Winterstien, C. M. Bunck, and P. D. Curtis, 1989, Survival analysis in telemetry studies: the staggered entry design. Journal of Wildlife Management 53:7-15 and Kaplan, E. L.

April 30th. Calf recruitment values were derived from annual estimates of female calves per adult female during late February/early March population composition surveys (i.e., calves at 9 to 10 months of age).

The reasons for the threat to woodland caribou populations are numerous, overlapping, and complex. To date, there has not been one single contributing factor that has attributed to the threat; it is generally a combination of various factors working in concert. These factors include; habitat fragmentation and loss through industrial activities, insects, disease, fire, and increased predation. As the habitat changes, creating a younger forest, there is an increase in desired forage for alternate prey such as moose, elk and deer, which results in an increase in their populations. The increase of alternate prey subsequently supports an increase of natural predators such as wolves. Industrial development of permanent and temporary roads, non-vegetated seismic lines, and recreational vehicle access create easier access for wolf travel which increases the vulnerability of caribou. Generally these types of corridors are clear of fallen trees and snow packed in the winter, which makes them preferred routes of travel for wolves. Other predator species are grizzly/black bear and wolverines.

The *Federal Recovery Strategy for Woodland Caribou, Boreal Population, in Canada* was released on October 2012 (Environment Canada, 2012). The recovery strategy has identified that range plans must be completed by responsible jurisdictions within 3-5 years of the posting of the recovery strategy. The *Federal Recovery Strategy for Woodland Caribou, Boreal Population* states that:

- *Range plans will outline how the given range will be managed to maintain or attain a minimum of 65% undisturbed habitat over time¹⁷; and*
- *Each range plan should reflect disturbance patterns on the landscape, as measured and updated by the provinces and territories, and outline the measures and steps that will be taken to manage the interaction between human disturbance, natural disturbance, and the need to maintain or establish an ongoing, dynamic state of a minimum of 65% of the range as undisturbed habitat at any point in time to achieve or maintain a self-sustaining local population* (Environment Canada, 2012).

The Little Smoky caribou range is identified in the federal recovery strategy as 95% disturbed.

The Government of Alberta commits to moving the caribou range towards a trajectory of 65% undisturbed habitat and achieving naturally-sustaining caribou populations in the province largely through habitat recovery (AESRD, 2015b). The GoA will be developing range plans to protect the herds and adhere to federal recovery strategy. The LS/ALP is the first range plan and is already underway. The range planning process is very complex as there is a need to balance all values on the landscape. Canfor has followed the GoA range planning process closely, consulted key AESRD Fish and Wildlife personnel,

and P. Meier, 1958. Nonparametric estimation from incomplete observations. *Journal of the American Statistical Association* 53:457-481.

¹⁷ “The total disturbance footprint was measured as the combined effects of the fire that has occurred in the past 40 years and buffered (500 m) anthropogenic disturbance defined as any human-caused disturbance to the landscape that could be visually identified from Landsat imagery at a scale of 1:50,000” (Environment Canada, 2012).

provided representation on behalf of the Canadian Boreal Forest Agreement (CBFA) on the Multi-Stakeholder Advisory Group, supplied technical information and advice via the Foothills Landscape Management Forum, and input as part of Alberta Forest Products Association.

The Canadian Boreal Forest Agreement was signed by Environmental Non-government Organizations (ENGO) and the Forest Products Association of Canada (FPAC) of which Canfor is a member, in May of 2010. There are 6 goals of which goal 3 is *“fast track plans to protect boreal forest species at risk, particularly woodland caribou”* (CBFA, 2010).

Canfor has been actively participating on committees and caribou research since the 1990's. Canfor is a member of the Foothills Landscape Management Forum (FLMF). The FLMF membership is comprised of forest and energy companies. Integrated Land Management in west-central Alberta totaling 42,030km² is one of FLMF's goals and would not be possible without the diversity of the membership. The FLMF interest area includes all Zones as indicated in Figure 88. Some FLMF initiatives that assist the Alberta and Canadian Government in the goal to maintain healthy caribou populations include:

- Berland-Smoky Regional Access Development Plan;
- Status of vegetation of lineal disturbance within the caribou ranges;
- West-Central Alberta Caribou Habitat Selection Analysis;
- Provide information to Alberta Government to assist in the development of LS/ALP Caribou Range Plan; and
- Caribou Road Patrol Program.

Canfor's FMA area overlaps with the Little Smoky (LS) and A La Peche (ALP) caribou herd's ranges (Figure 86). The boundaries of the two herds also extend into other forestry tenure areas. The ALP caribou herd migrates into Wilmore Wilderness Park in the winter whereas the LS caribou herd generally does not migrate during the winter seasons. The ALP caribou range is 661,219ha (not including the area within Wilmore Wilderness Park) in size and only a small portion (701ha) is located within Canfor's FMA area. The LS caribou range is 308,715ha, of which 70,609ha overlaps Canfor's FMA area.

Table 45 Total Little Smoky & A La Peche Caribou Management Area

Range	Zone (Ha)			Total
	1	2	3	
A La Peche	32,542	628,676		661,219
Little Smoky	100,488	208,227		308,715
RAD			355,173	355,173
Total	133,031	836,903	355,173	1,325,107

Table 46 Total Caribou Range Area (LHS) & Canfor FMA Caribou Range Area (RHS)

Range	Zone (Ha)		Total	Range	Zone (Ha)		Total
	1	2			1	2	
A La Peche	32,542	628,676	661,219	A La Peche		701	701
Little Smoky	100,488	208,227	308,715	Little Smoky	15,136	55,473	70,609
Total	133,031	836,903	969,934	Total	15,136	56,174	71,310

Table 47 Percent of Total Caribou Range in Canfor FMA Area

Caribou Range	Total Area (Ha)	FMA (Ha)	Range %	FMA %
A La Peche	661,219	701	0.1%	0.1%
Little Smoky	308,715	70,609	22.9%	11.0%
Total	969,934	71,310	7.4%	11.1%

Table 48 Percent of Canfor FMA Caribou Range Area by Herd

Range	Zone (%)		Total
	1	2	
A La Peche		0.1%	0.1%
Little Smoky	15.1%	26.6%	22.9%
Total	11.4%	6.7%	7.4%

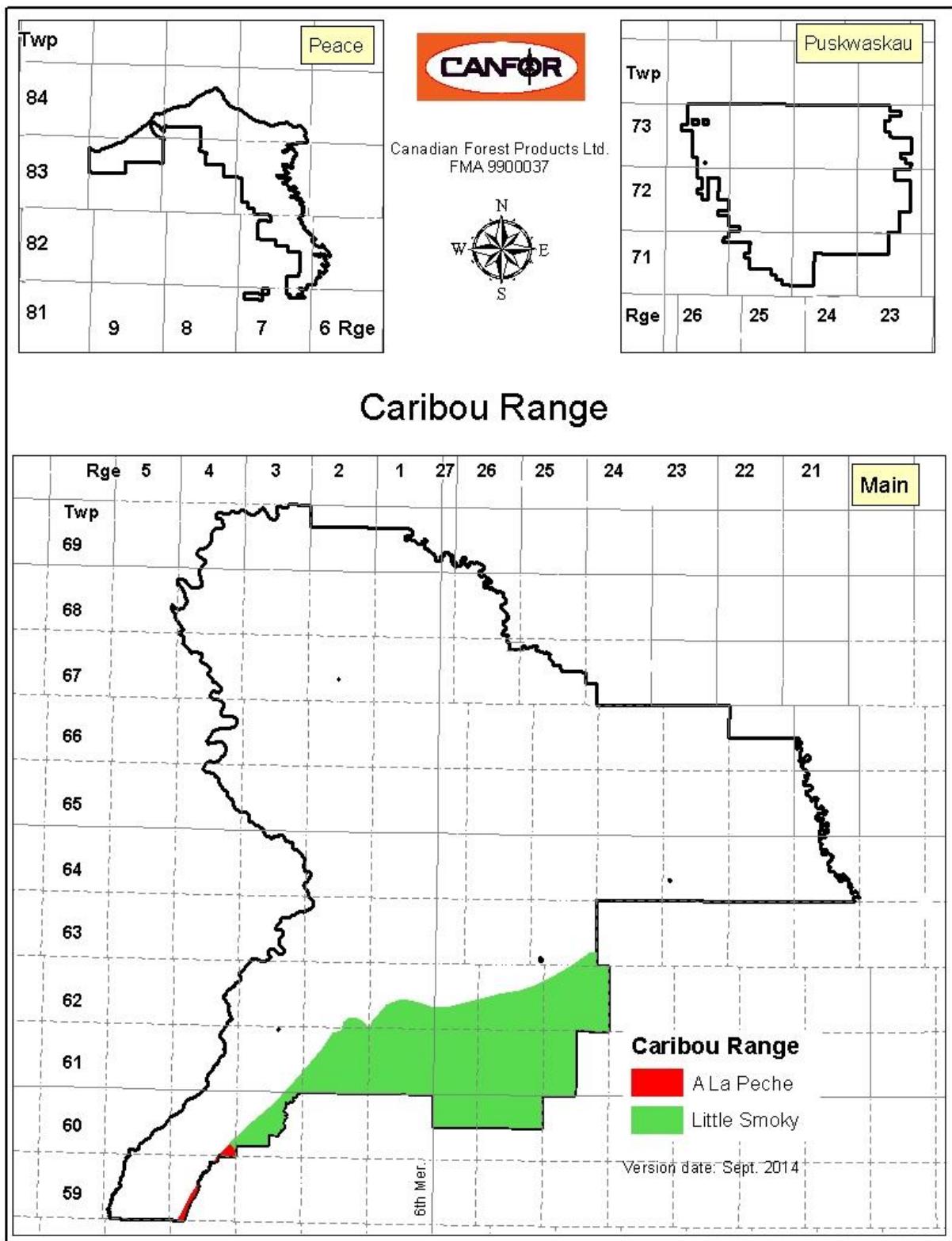


Figure 86 Caribou Range in Canfor's FMA Area

History of Caribou Management on Canfor's FMA Area

Canfor has been implementing caribou management strategies on the FMA area since 1991 and has contributed over one million dollars towards caribou initiatives from 1997-2014 (Table 49). A history of caribou management on Canfor's FMA area is outlined in Figure 87.

Table 49 Canfor Contributions to Caribou Research Initiatives

Initiatives	1997 - 2014 Total
West Central Alberta Caribou Standing Committee	\$77,923
University of Alberta	\$255,500
Natural Sciences and Engineering Research Council Scholarship	\$5,500
Canfor Track Monitoring Program	\$168,631
Caribou Range Recovery Project	\$3,667
Caribou Habitat Assessment	\$50,160
Little Smoky Caribou Calf Survival Enhancement Project	\$16,000
Foothill Landscape Management Forum (formerly Caribou Landscape Management Association)	\$80,000
West Central Alberta Caribou Landscape Plan (formerly CLMA Caribou Adaptive Management Plan)	\$70,900
Suncor Caribou Restoration Pilot Project	\$106,042
Caribou Research and Analysis Project	\$10,000
NCASI Caribou Nutrition Research	\$10,000
Caribou Range Plan Timber Supply Contributions	\$7,830
Foothills Landscape Management Forum Activities	\$213,356
Total	\$1,075,509

1991

- Incorporated aspects of caribou management in the Forest Management Plan (FMP) which included a 30 year deferral on previous identified caribou core area

1998

- Caribou named as one of seven indicator species on the FMA area for next Forest Management Plan

2001-2002

- Reforestation of 57 kilometers of linear corridors

2003

- Applied habitat cover constraints in the FMP

2004

- Initiated independent assessment of habitat quality and effectiveness to guide strategic planning

2005

- Deferred harvest for 2 years in caribou area south of Deep Valley Creek

2007

- Continued cautionary approach and further defers harvest in caribou area for another year south of Deep Valley Creek

2008

- Amidst concerns of a MPB outbreak, Canfor continued a cautionary approach and further deferred harvest in caribou area south of Deep Valley Creek for another year

2009

- Canfor committed as part of its healthy pine strategy to a 15 year harvest deferral in the primary intactness zone and continuation of harvest deferral south of Deep Valley Creek

2012

- Canfor further extended its commitments in the Healthy Pine Strategy and deferred harvest south of the Deep Valley Creek until which time a Caribou Range Plan is released

Figure 87 History of Caribou Management Strategies on Canfor's FMA Area

7.4.1.5.1 Management Strategies

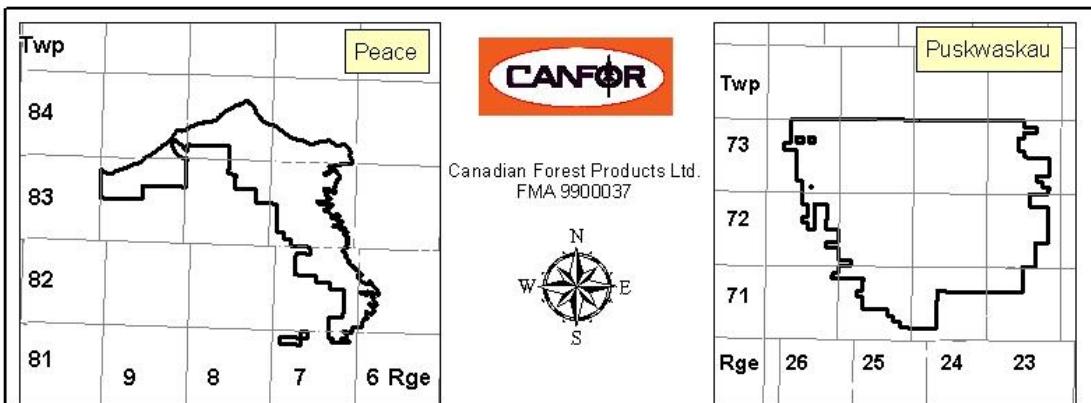
From current knowledge and recommendations Canfor has developed caribou management strategies that are applied to this FMP. Canfor recognizes that upon completion of the LS/ALP Caribou Range Plan, these strategies will be reviewed and adjusted if necessary to meet the range plan requirements. Canfor's management strategies, outlined below, will assist the Federal and Alberta governments to maintain healthy caribou populations in the LS and ALP herds through deferrals and focusing harvest in fragmented areas first percent to ensure that the amount of disturbed area is not further increased.

- Three Zones proposed: Conservation (Zone 1), Expansion (Zone 2) and Support (Zone 3) (Figure 88 & Figure 89).
 - Conservation Zone:
 - No harvest in the Conservation Zone for 10-years and harvest up to 5% of the THLB area after year 10. Canfor anticipates that most of the volume will be comprised of timber salvage received from the energy sector and not from the development of harvest blocks; and
 - Reduction of forage for alternate prey through implementation of vegetation management following harvest.
 - Expansion Zone:
 - Harvest in the Expansion Zone will be scheduled based on a MPB priority; however, will focus on the already fragmented areas within the Expansion Zone for a minimum of 5 yrs.;
 - Defer harvest in timber supply sub-units south of the Deep Valley (DS-3, DS-4 and DS-5) for 5 years within the Expansion Zone. These sub-units are relatively intact, but do contain highly susceptible pine that will be at risk to MPB infestation;
 - Defer harvest in four additional timber supply sub-units (DS-1, DS-2, DS-6 AND DS-7) for 10-years within the Expansion Zone; and
 - Reduction of forage for alternate prey through implementation of vegetation management following harvest.
 - Support Zone:
 - Reduction of forage for alternate prey through implementation of vegetation management following harvest..
- Canfor will not build any permanent road infrastructure south of the Deep Valley. All Canfor access will be temporary and built to the lowest standard possible in addition to prompt reclamation.
- Canfor is also supportive of the concept of habitat recovery through reclamation and restoration and will support where feasible, opportunities that arise to do so.
- Canfor will continue to reforest seismic lines that are adjacent to harvest boundaries on areas that support tree growth.
- Canfor is aware that the above caribou strategies in addition to MPB strategies may result in risk to watersheds. Canfor will continue to work diligently with the local Fish and Wildlife and Water



biologists to develop strategies and best management practices that reduce the risk to watersheds.

- Canfor supports AESRD's Mountain Pine Beetle level 1 activities and recommends these activities be focused in the Caribou Range south of the Deep Valley where Canfor is not operating in the next 5 to 10-years.



Caribou Management Zones

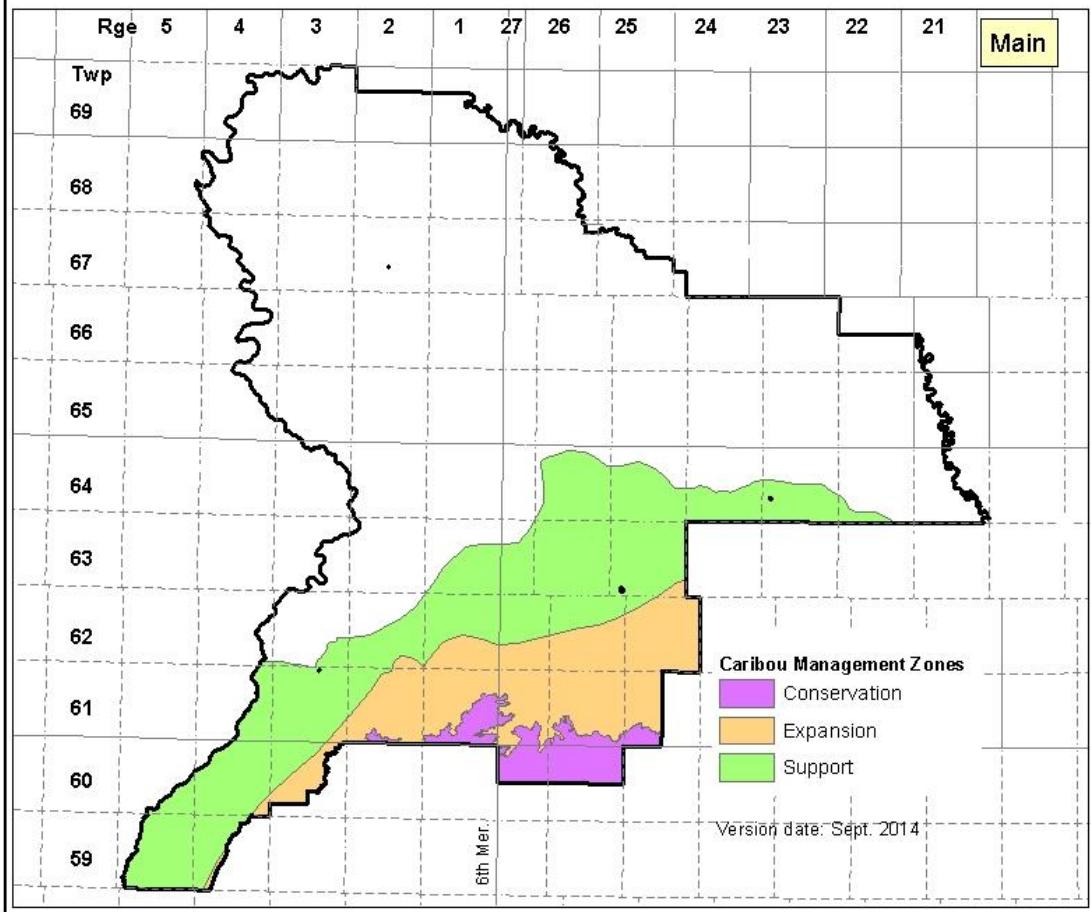


Figure 88 Caribou Management Zones

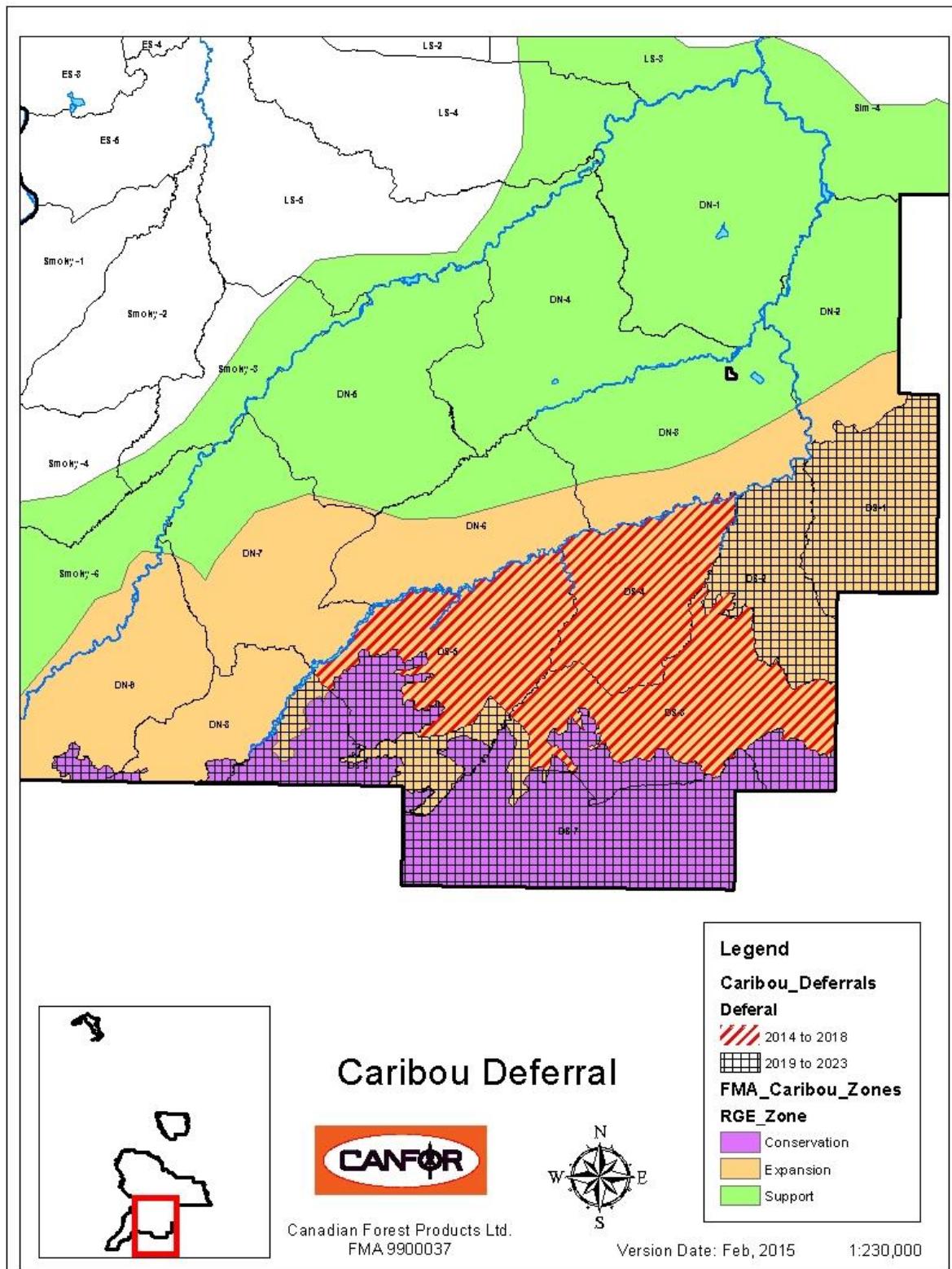


Figure 89 Caribou Deferral Areas

7.4.1.5.2 Current and Forecasted Caribou Management Area Conditions

Age Class within the Caribou Range

The age of the forests change over time. Caribou are generally an older age class species. Based on the PFMS, Figure 90 shows that the 121+ year age class peaks around year 10, which is a direct result of the harvest deferrals applied. At no time during the 200-year planning horizon does 121+ ageclass drop below 35%.

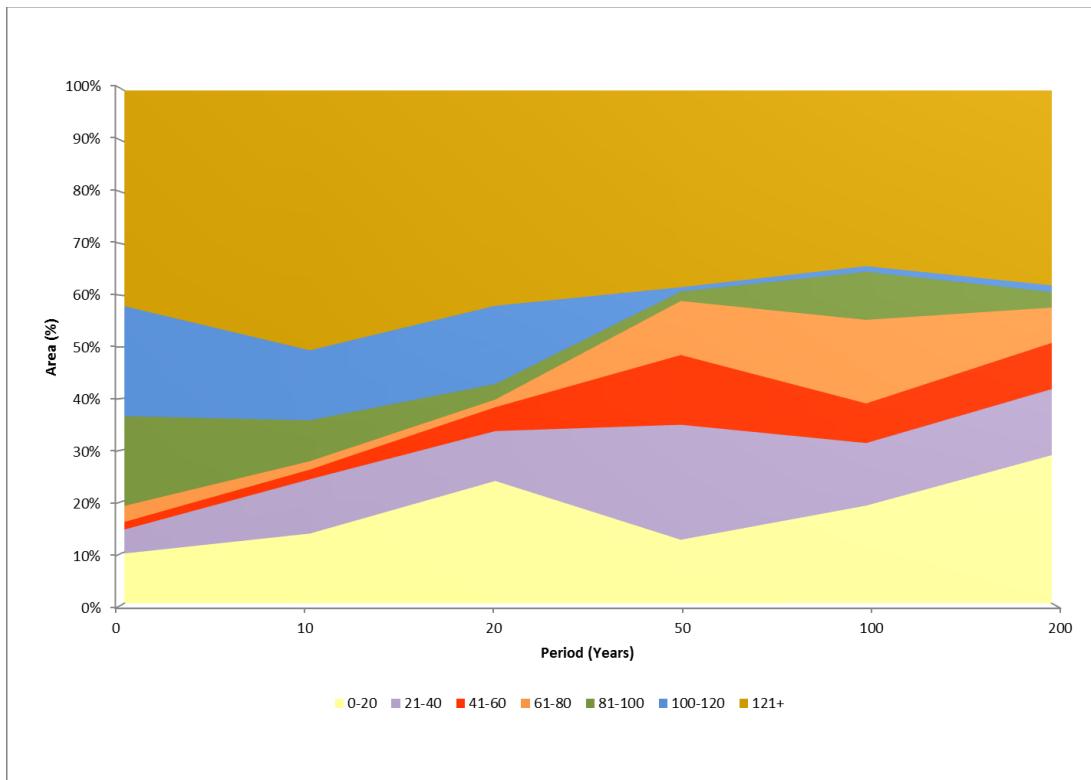


Figure 90 Current and Forecasted Forest Age Class Distribution of the Caribou Range

Harvest History

Harvesting has occurred in the Caribou Range since the 1960s with most of the logs sawn by local bush mills. Canfor did not start harvesting in the Caribou range until 1987. There is very little information on the areas harvested prior to Canfor's operations. Figure 91 illustrates the harvest history in the Caribou range and Figure 92 shows the distribution since 1965.

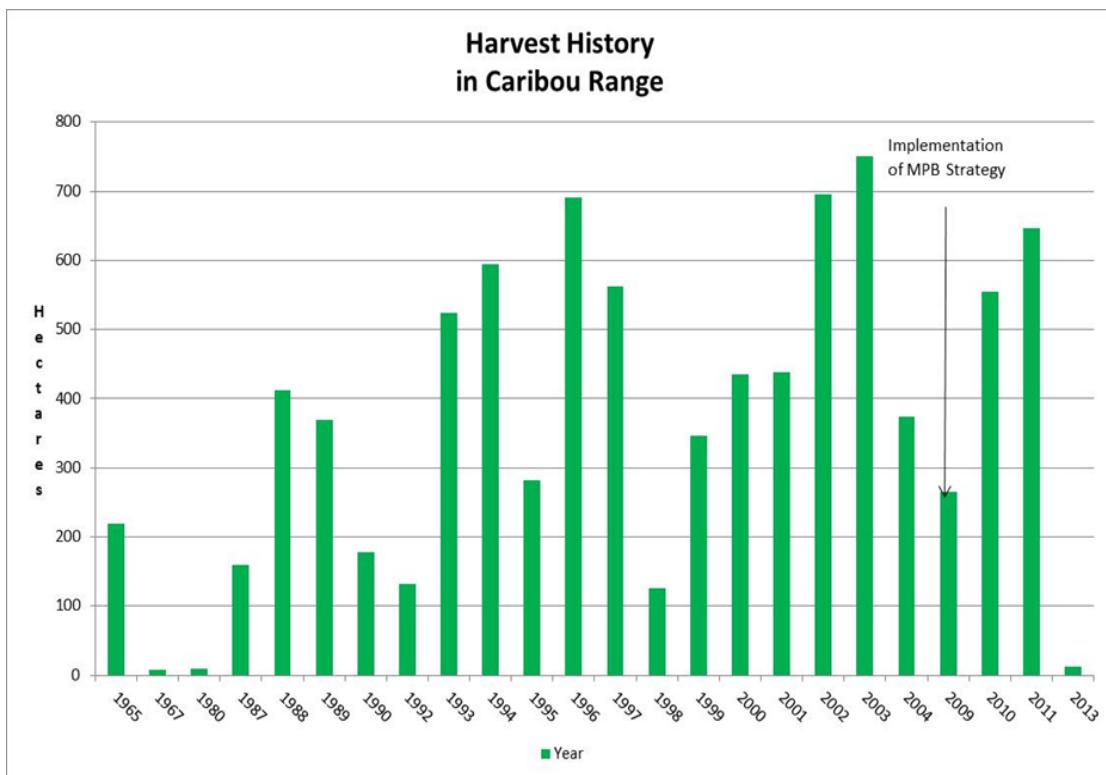


Figure 91 Harvest History in Caribou Range

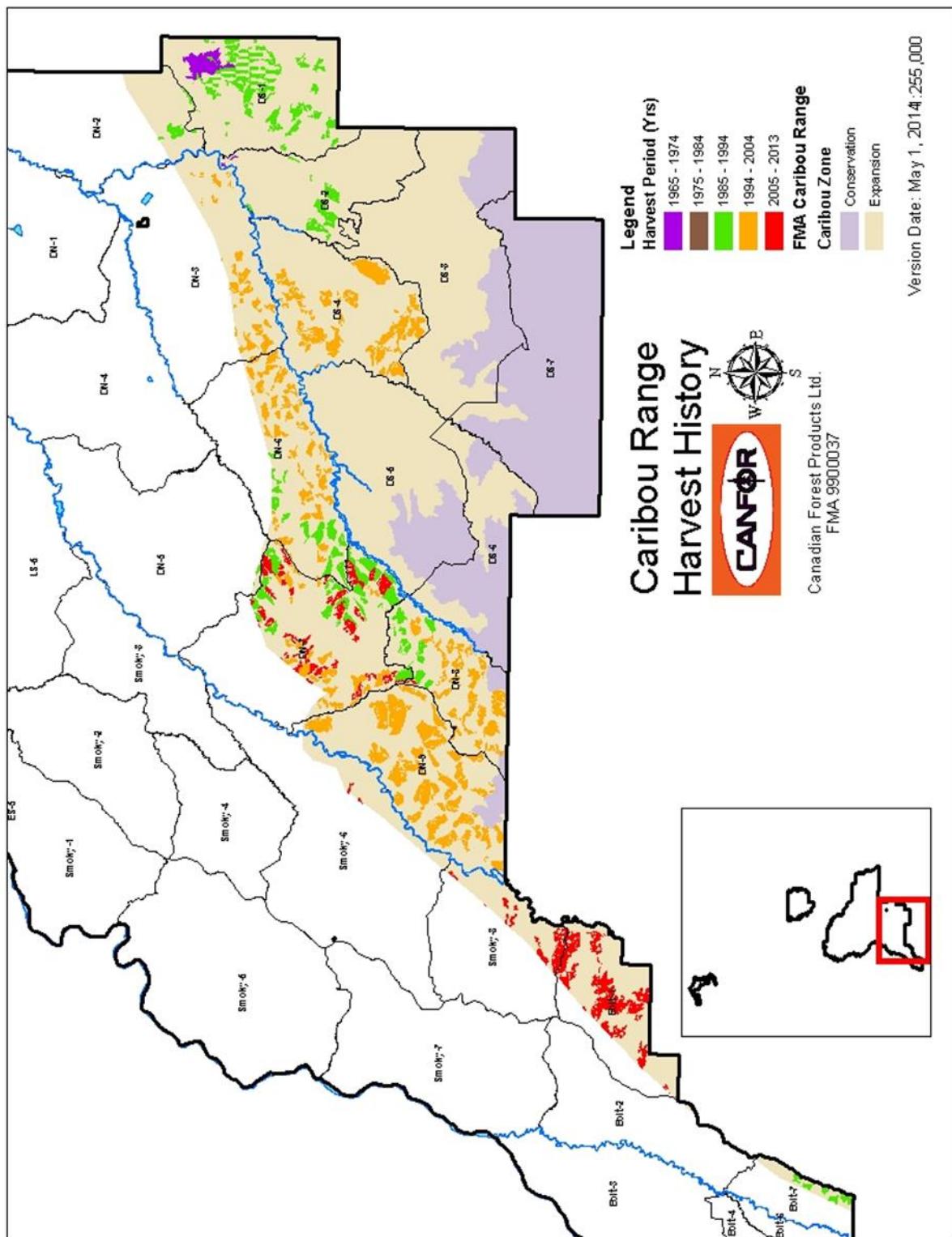


Figure 92 Caribou Range Historic Harvest Distribution

Human Disturbance

“Environment Canada mapped total disturbance levels on boreal caribou ranges across their distribution in Canada as a predictor of self-sustainability for boreal caribou local populations. The total distance footprint was measured as the combined effects of fire that has occurred in the past 40 years and buffered (500m) anthropogenic disturbance defined as any human-caused disturbance to the landscape” (Environment Canada, 2012). The following graphs and maps will show the breakdown and location of disturbance using the 500m disturbance buffer for four disturbance types (open roads, seismic lines, other disturbance such as power lines, pipe lines, well sites, gravel pits etc. and harvested blocks). As the figures illustrate, the buffered disturbance types overlap throughout the range.

When buffers are added, the largest footprint in the caribou range is a result of historic seismic lines. Most historic seismic lines were between 5m and 8m in width, but current seismic line practices are low impact and result in less disturbance.

Forest harvest disturbance within the caribou range on the FMA area is currently at 47% (Table 50). Harvest levels in the mid-80s increased as Canfor’s FMA area increased due to an addition that included area in the caribou range. There were no caribou strategies in place at that time. Since the nineties, Canfor has applied caribou management strategies in FMPs and harvesting has been limited to the north western portion of the caribou range, mainly to address MPB.

Table 50 Disturbance Area by Type in Canfor FMA Caribou Range (500m Buffer)

Disturbance Type	Disturbance (Ha)	% Individual Disturbance
Access	32,897	46.1%
Siesmic	69,858	98.0%
Other Human Disturbance	34,717	48.7%
Harvested	33,565	47.1%

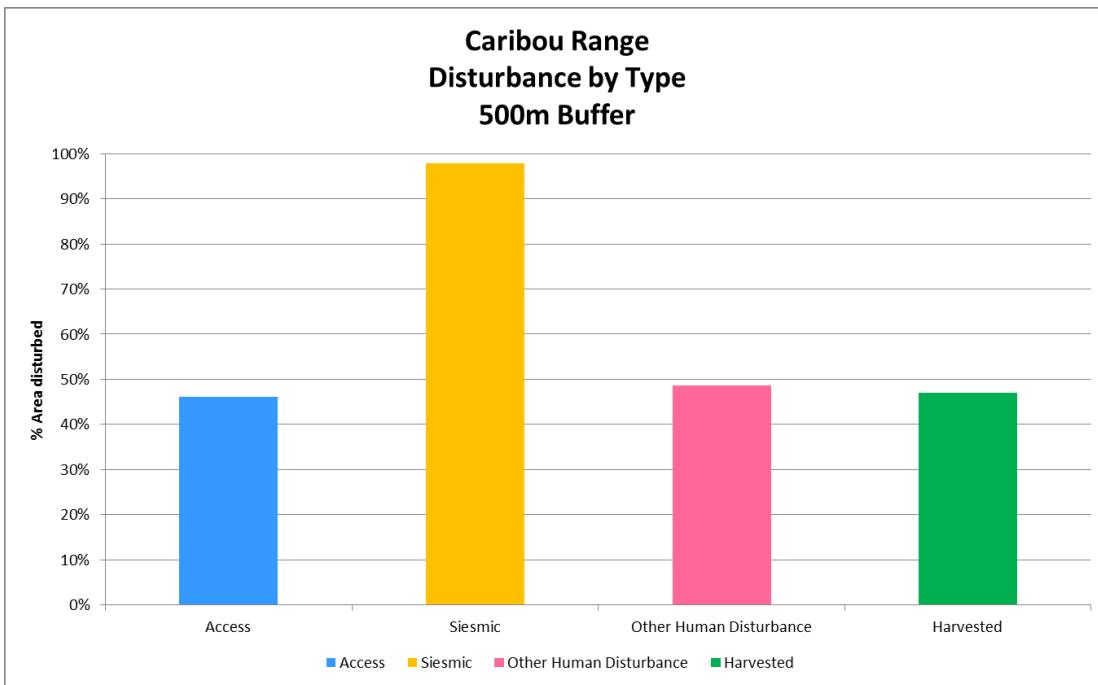


Figure 93 Caribou Range Disturbance by Type (500m Buffer)

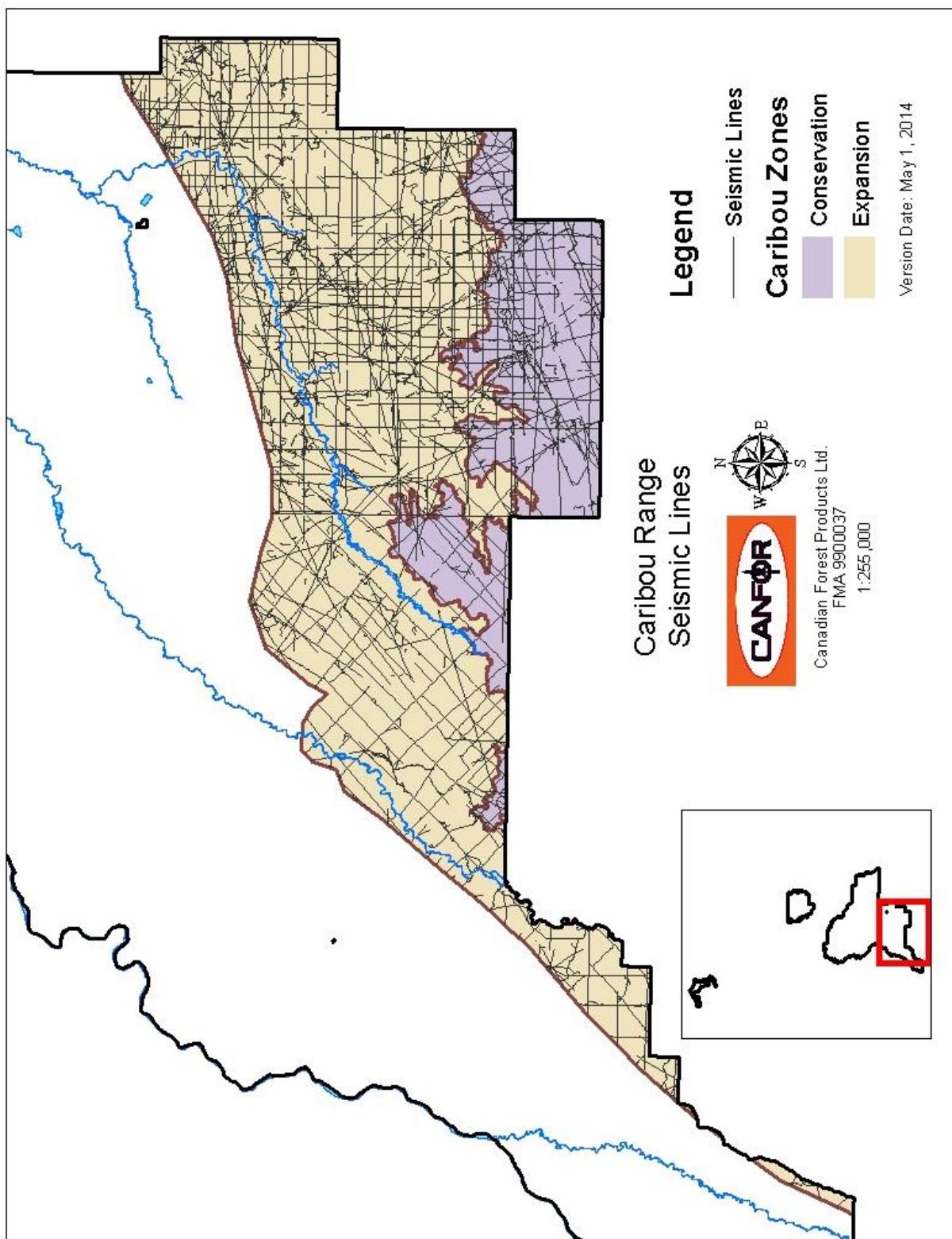


Figure 94 Caribou Range Seismic Lines

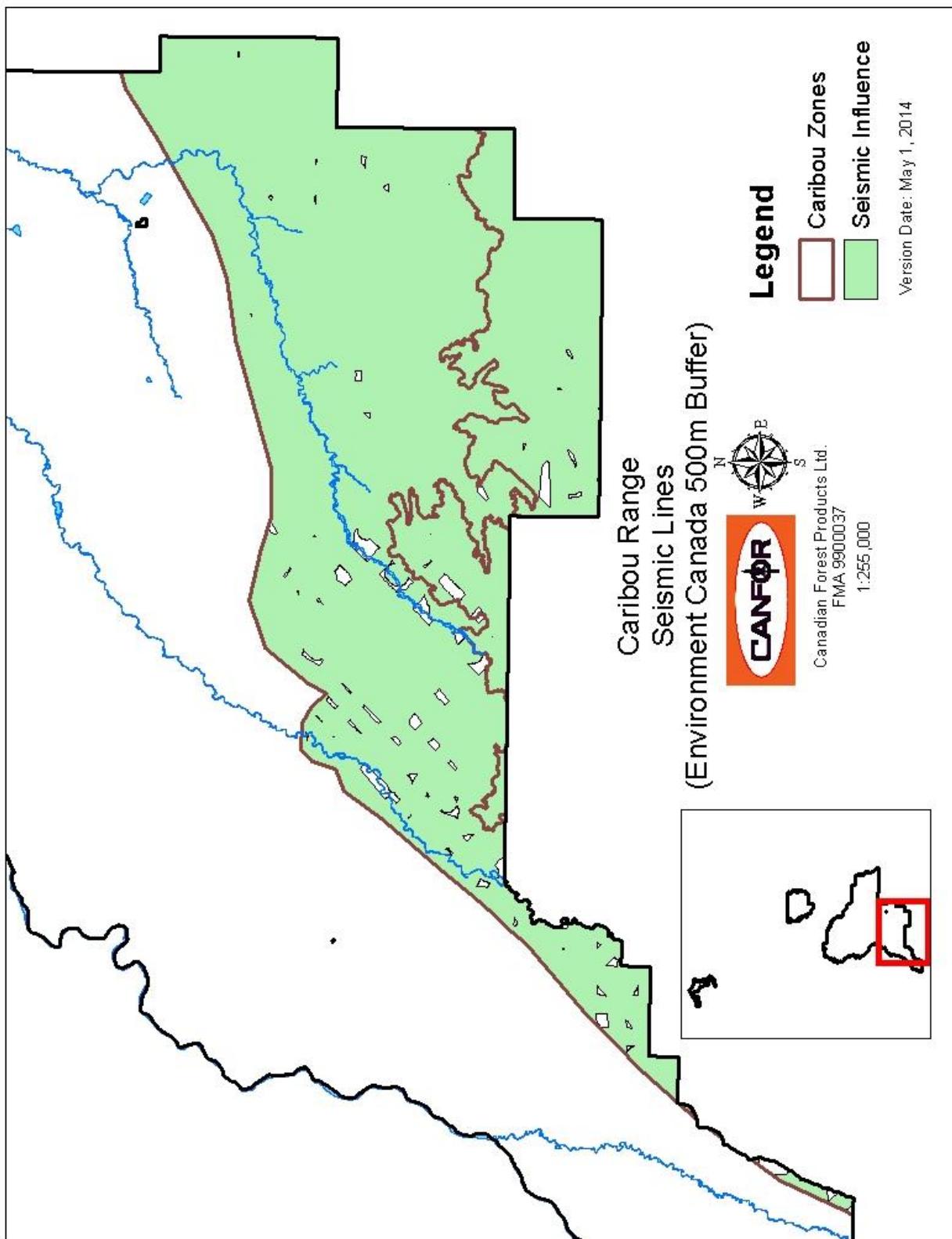


Figure 95 Caribou Range Seismic Lines (Environment Canada 500m Buffer)

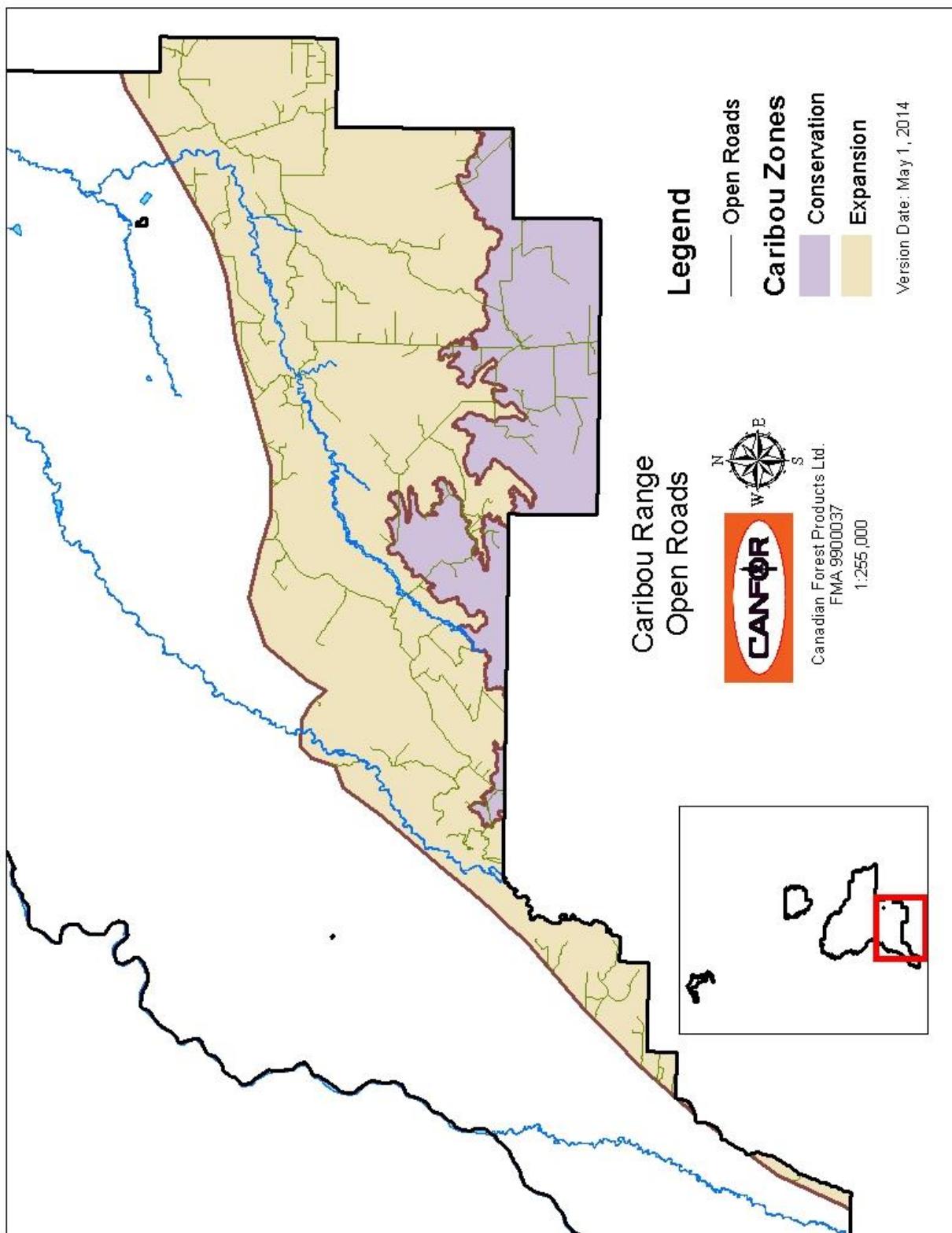


Figure 96 Caribou Range Open Roads

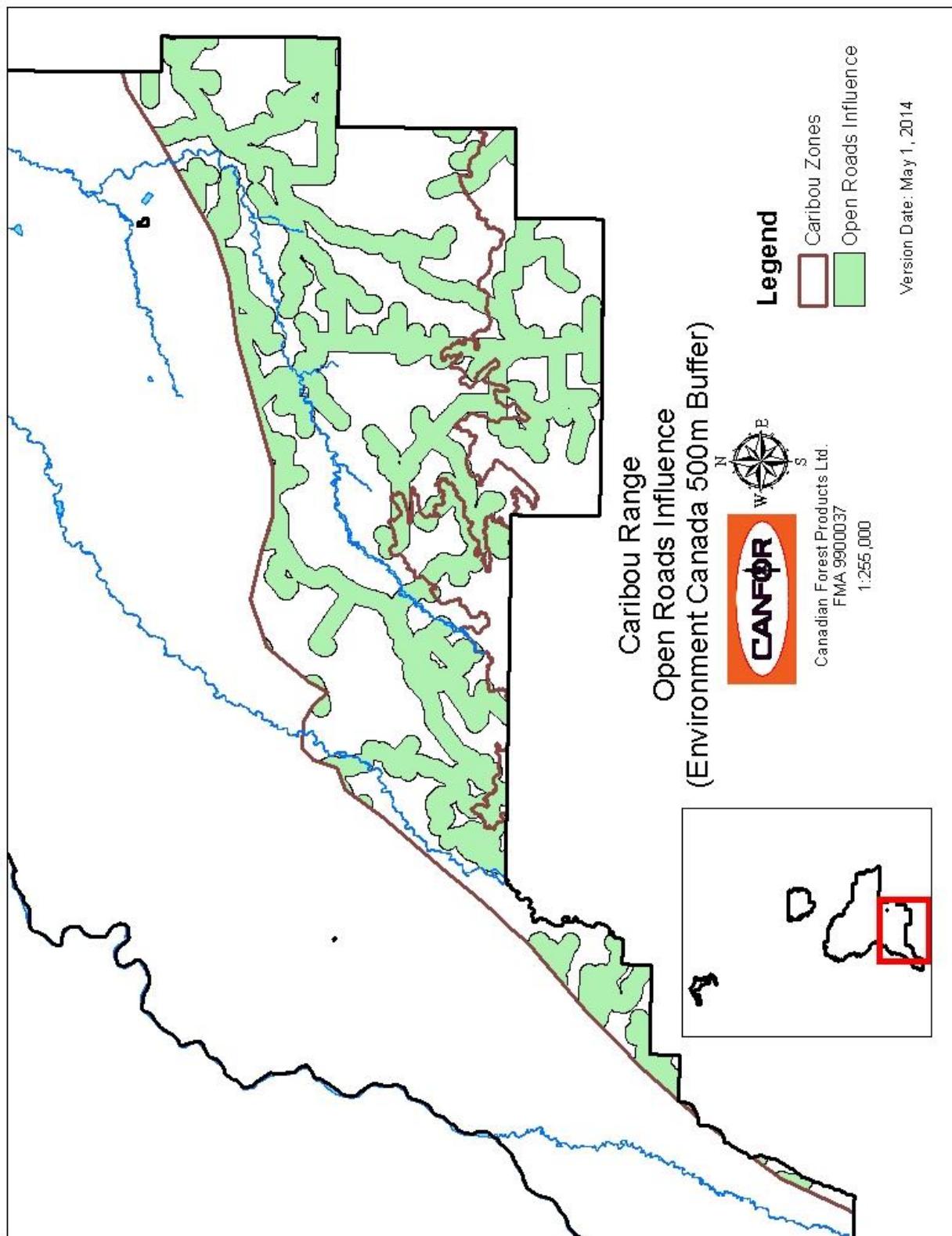


Figure 97 Caribou Range Open Roads Influence (Environment Canada 500m Buffer)

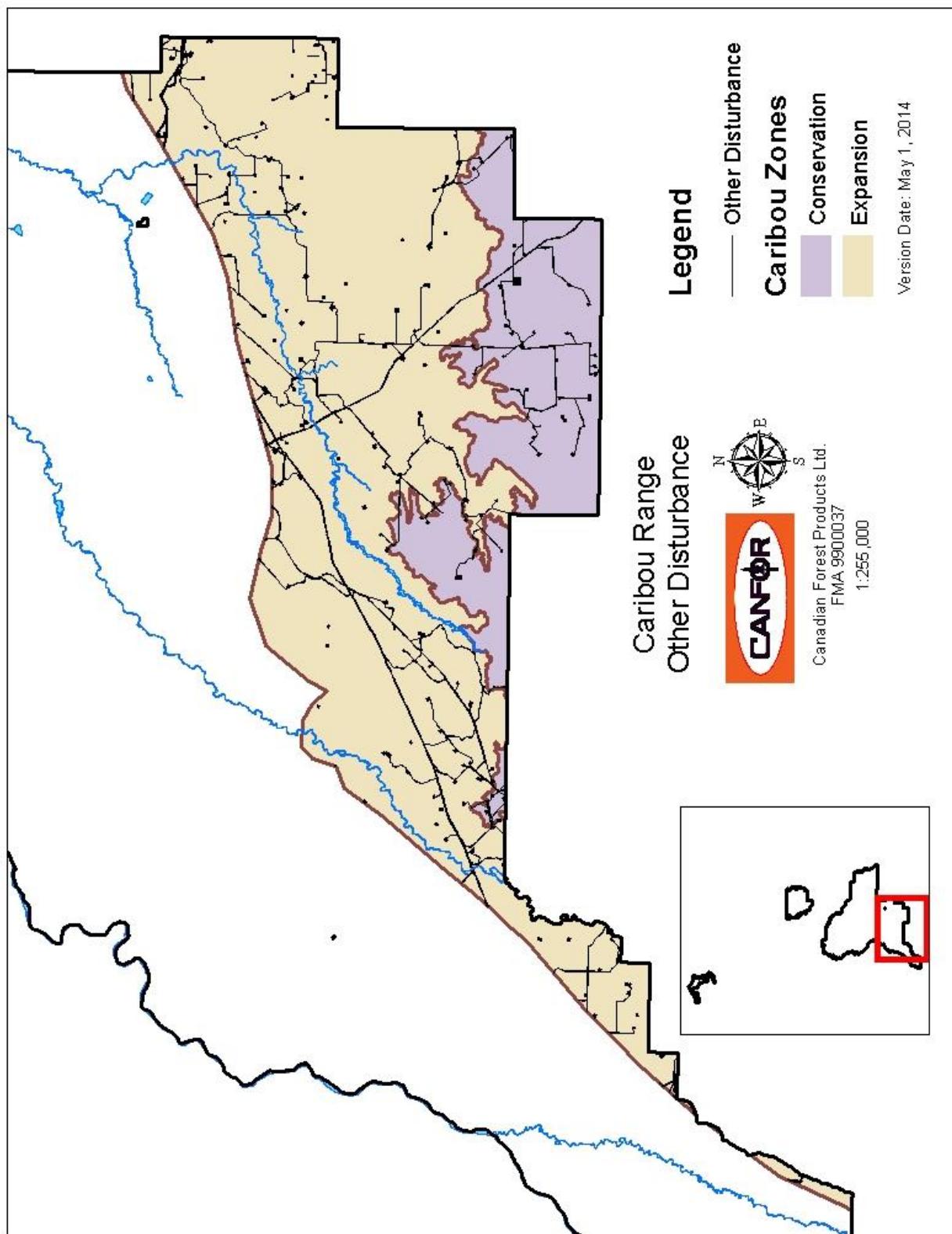


Figure 98 Caribou Range Other Disturbance

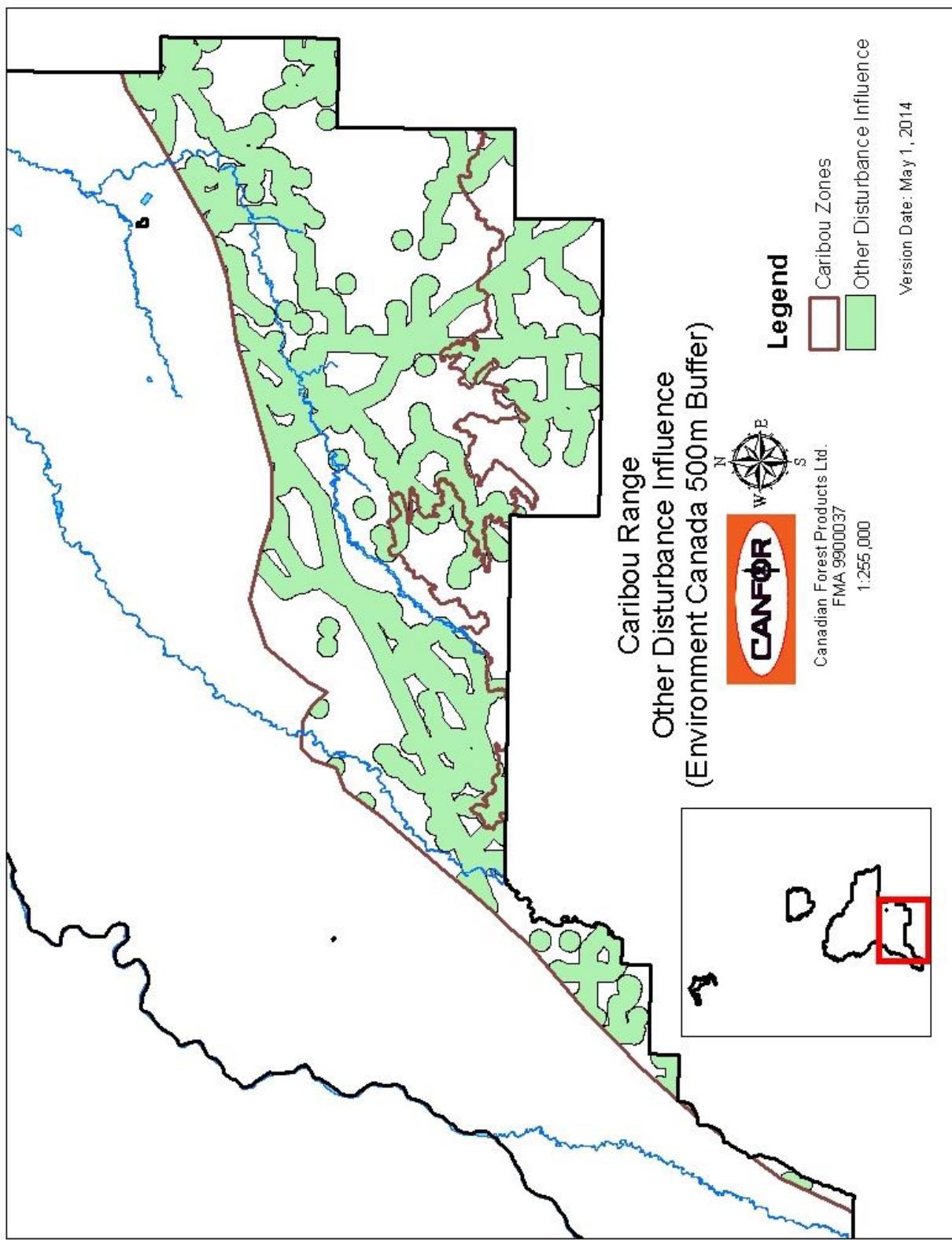


Figure 99 Caribou Range Other Disturbance (Environment Canada 500m Buffer)

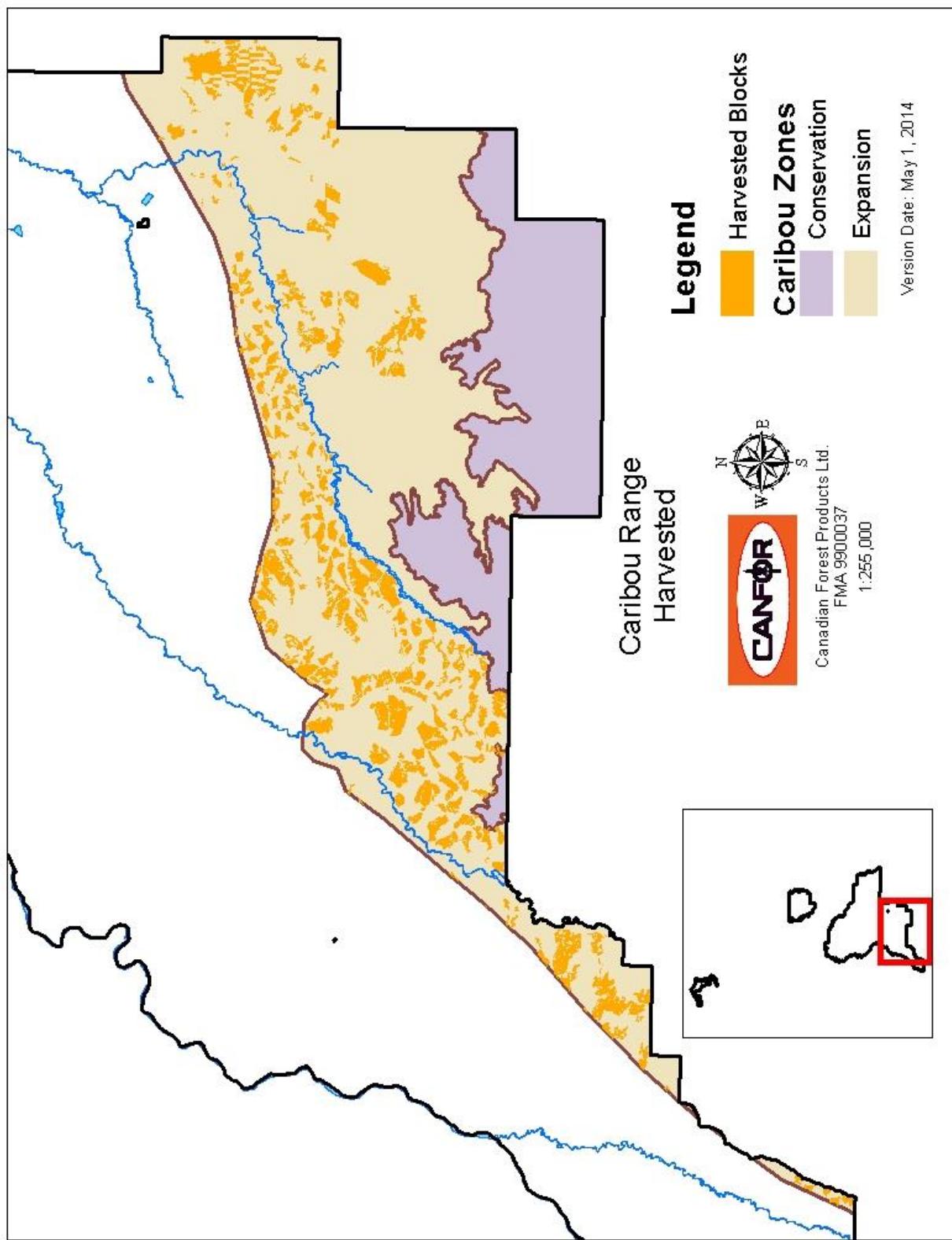


Figure 100 Caribou Range Harvested Disturbance

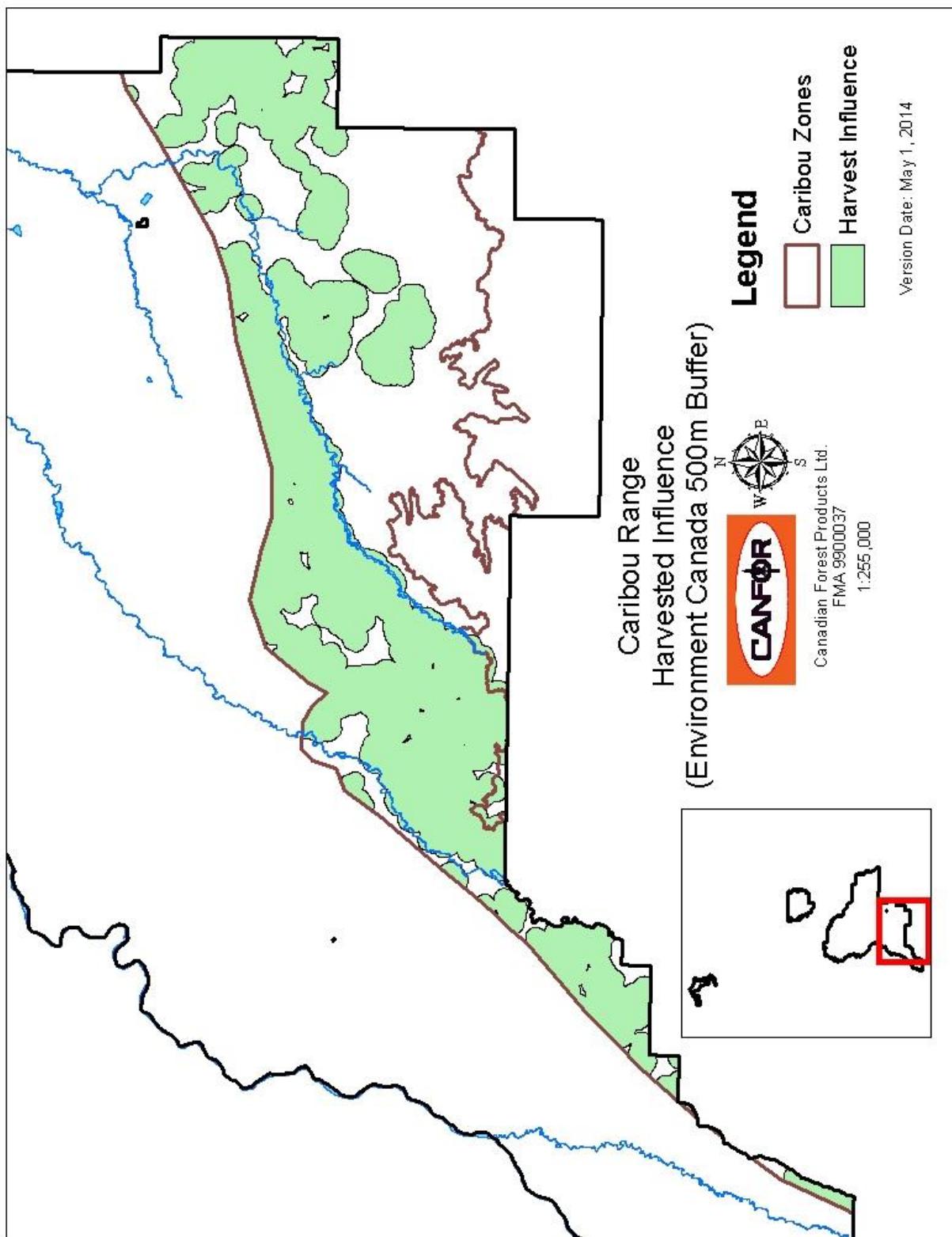


Figure 101 Caribou Range Harvest Disturbance (Environment Canada 500m Buffer)

7.4.1.6 Grizzly Bear

Despite a greater than 50% decline in global distribution, Western Canada retains a significant amount of core grizzly bear habitat in North America. Alberta's grizzly bears are part of the Western population (as defined in May 2012). They have been designated as a Species of Special Concern by COSEWIC and have also been designated as a threatened species in Alberta. In 2002, the Provincial Government established a Grizzly Bear Recovery Team, responsible for developing the *Alberta Grizzly Bear Recovery Plan 2008-2013* (AESRD, 2008a). The recovery plan and recommendations were reviewed in 2013-14 in order to evaluate progress and initiate planning for subsequent recovery plans.



Figure 102 Grizzly Bear

Provincial conservation priorities include: reducing human/bear conflicts and human-caused mortality; improving knowledge and establishing reliable population estimates for grizzly bears in Alberta; identification, tracking and maintaining habitat; and the improvement and delivery of education and outreach. To date, Canfor has contributed \$885,855 to support grizzly bear research since 2000.

Grizzly bears have no natural predators. Their primary causes of mortality are human-related (including licensed hunting, illegal, self-defense kills and road/rail collisions). Increased human access and activity in grizzly bear habitat results in increased human/bear conflicts and subsequently increased bear mortality. Controlling access, development, and other human activities in grizzly bear habitat is a key recommendation in the *Alberta Grizzly Bear Recovery Plan 2008-2013* (AESRD, 2008a).

Ecology

Grizzly bears (*Ursus arctos*) are distinguished from black bears by their distinctive shoulder hump, facial disk, and larger size. Colour varies from blonde to brown and is not a reliable factor for identification. Males (200-300kg) are larger than females (100-200kg) and require larger home ranges. Females in Alberta reach maturity and produce their first litter between 4 and 8 years of age. Cubs (usually 1-3) are born in January or February in the den and remain with their mothers for two to five years. Their slow reproductive rate is a limiting factor in the persistence and recovery of populations.

Grizzly bears are habitat generalists and opportunistic omnivores. The abundance and diversity of preferred foods is a primary factor in habitat selection for this species. This accounts for seasonal and diurnal variation in habitat use. Important food sources include: ants; plants with tuberous roots (e.g. *Hedysarum spp.*); herbaceous plants (e.g. *Heracleum lanatum*, *Carex spp.*, *Equisetum spp.*, etc.); berry producing shrubs (e.g. *Vaccinium spp.*, *Shepherdia Canadensis*, *Sambucus racemosa*, *Ribes spp.*, *Cornus stolonifera*, etc.); carrion; ground squirrels; fish; and ungulates. During spring, they tend to feed on herbaceous plants in avalanche chutes and other moist areas. Throughout the remainder of the year they use a mosaic of forested habitats; forested stands with a minimum of 25% canopy closure in

proximity to open and early seral stage stands are necessary for thermal and security cover for day beds (McLellan & Hovey, 2001).

In the fall (October through late November), grizzly bears seek den sites, with pregnant females entering first and emerging later than males (Ciarniello L. , Boyce, Heard, & Seip, 2005).

Habitat

High quality grizzly bear habitat is relatively free from human disturbance. It requires a mosaic of open and forested stands covering large areas. This eliminates high rates of human-caused mortality and allows for seasonal variation in the availability and abundance of resources. In areas where human populations and resource development encroach on grizzly bear habitat, it is critically important to minimize the impacts and where possible mimic ideal habitat characteristics. Restricting unnecessary access along with strong educational and outreach programs are likely to be the most effective tools for reducing human/bear conflict and associated bear mortality. Habitat management should focus on maintaining, monitoring and enhancing key habitat features. Primary and secondary grizzly bear habitats were identified in the Sub-alpine, Upper and Lower Foothill Subregions of the Main parcel of Canfor's FMA area in the development of the *Alberta Grizzly Bear Recovery Plan 2008-2013* (AESRD, 2008a)(Figure 103).

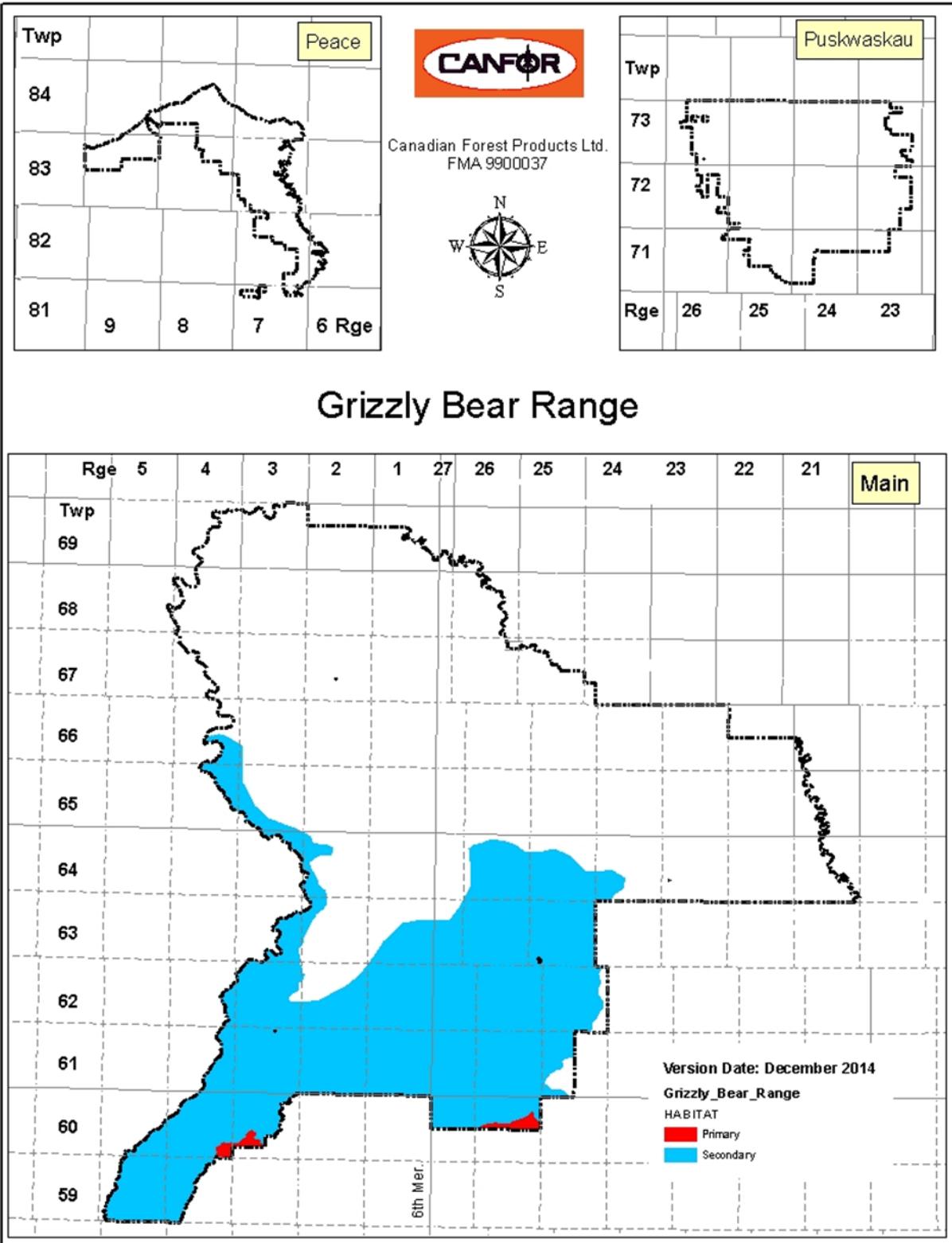


Figure 103 Canfor FMA Area Grizzly Bear Range

Key Habitat Features

- Open stands, often fire successional, with a well-developed shrubby understory –
 - Many critical grizzly bear food sources (ants, herbaceous plants, roots and tubers, etc.) are more abundant and diverse within clearcuts than forest stands (Hammer and Herrero, 1987; Hammer et al., 1991).
- Moist riparian forest and stands with moderate to high canopy closure (>30%) –
 - These areas are often used for feeding, resting, and as travel corridors;
 - The proximity of vegetative cover to open foraging habitat is vital to meet security and thermal cover requirements. Habitat connectivity is important locally to allow bears to move through their home ranges and on a larger scale to allow for juvenile dispersal and habitat establishment.
- Wet meadows, estuaries, skunk cabbage (*Lysichiton americanum*) swamps, and seeps –
 - Provide important food sources in early spring and many forage species require high moisture regimes to flourish.
- Shrubby avalanche chutes –
 - Another important spring foraging source (carrion and herbaceous vegetation).
- Subalpine and alpine areas on moderate to steep north and east facing slopes are preferred for dens –
 - Den sites are typically located away from roads and in areas with potential forage species (e.g. ground squirrels, marmots and berry producing shrubs), deep snowfall and suitable topography for denning. Bears may excavate dens into a slope or use natural cover (in caves, under tree roots, etc.) [(Vroom, Hererro, & Ogilvie, 1977), (Ciarniello L., Boyce, Heard, & Seip, 2005)]. Den site fidelity is common particularly amongst females and dens are occasionally reused. Availability of den sites is not believed to be a limiting factor in Alberta (AESRD, 2008a).

Forest Operations Related Impacts

Human-caused mortality is widely recognized as the primary driver of grizzly bear population declines. This is particularly evident along the peripheries of their range (McLellan & Shackleton, 1988), (Benn & Herrero, 2002), (Nielsen, Boyce, & Stenhouse, 2004a). The construction of roads in remote areas for resource extraction has been identified as a principle factor in increasing human access to grizzly bear habitat (McLellan & Shackleton, 1988), (McLellan & Hovey, 2001), (Gibeau, Clevenger, Hererro, & Wierzchowski, 2002), (Wielgus, Vernier, & Schivatcheva, 2002), (Roever, Boyce, & Stenhouse, 2008), (Stewart, et al., 2013), (Boulanger & Stenhouse, 2014). Grizzly bear mortality risk increases with proximity to roads.

Growth in human populations and resource extraction have significantly increased the frequency of human-bear interactions and grizzly bear mortality rates in previously inaccessible habitats [(Benn & Herrero, 2002), (Schneider, Stelfox, Boutin, & Wasel, 2003), (Nielsen, et al., 2004b), (Stewart, et al., 2013)]. Restricting human access to high quality habitats will reduce the risk of human-caused mortality [(Mattson, Herrero, Wright, & Pease, 1996), (Nielsen, et al., 2004b), (Roever, Boyce, & Stenhouse, 2008), (Stewart, et al., 2013)].

Modern fire suppression tactics have altered forest succession patterns. The reduction in naturally occurring openings, early seral stage or open stands in proximity to secure forest cover negatively impacts high quality grizzly bear habitat. Landscape level management practices involving the development of early seral stage communities in regenerating clearcuts, (particularly where open habitats are a limiting factor) may be used to enhance grizzly bear habitat and ultimately populations (Nielsen, Boyce, & Stenhouse, 2004a),& (2006); (Ciarniello L. , Boyce, Seip, & Heard, 2007); (Berland, Nelson, Stenhouse, Graham, & Cranston, 2008). Restricting human access to clearcuts intended to provide potential habitat surrogates should reduce the likelihood of these areas becoming attractive population sinks or ecological traps (Delibes, Gaona, & Ferreras, 2001); (Nielsen, et al., 2004b), (2006); (Berland, Nelson, Stenhouse, Graham, & Cranston, 2008).

Responsible forestry management practices are a critical component in ensuring the persistence of grizzly bears in North America (Clark, Paquet, & Curlee, 1996); (McLellan, 1998); (Nielsen, Boyce, & Stenhouse, 2004a); (Stewart, et al., 2013).

7.4.1.6.1 Management Strategies

Grizzly bear populations in the Grande Prairie FMA area are considered to be threatened by the Province. Risk to grizzly bears is generally linked to two attributes: road density and habitat quality. The proximity of good quality habitat to roads increases the risk of human caused mortality. The *Alberta Grizzly Bear Recovery Plan 2008-2013* has identified open road density thresholds of 0.6km/km² in the core and 1.2km/km² secondary grizzly Bear habitat areas (AESRD, 2008a). The ability to keep open road densities below these thresholds through strategic access and forest management planning will reduce the probability of interactions between grizzly bears and humans.

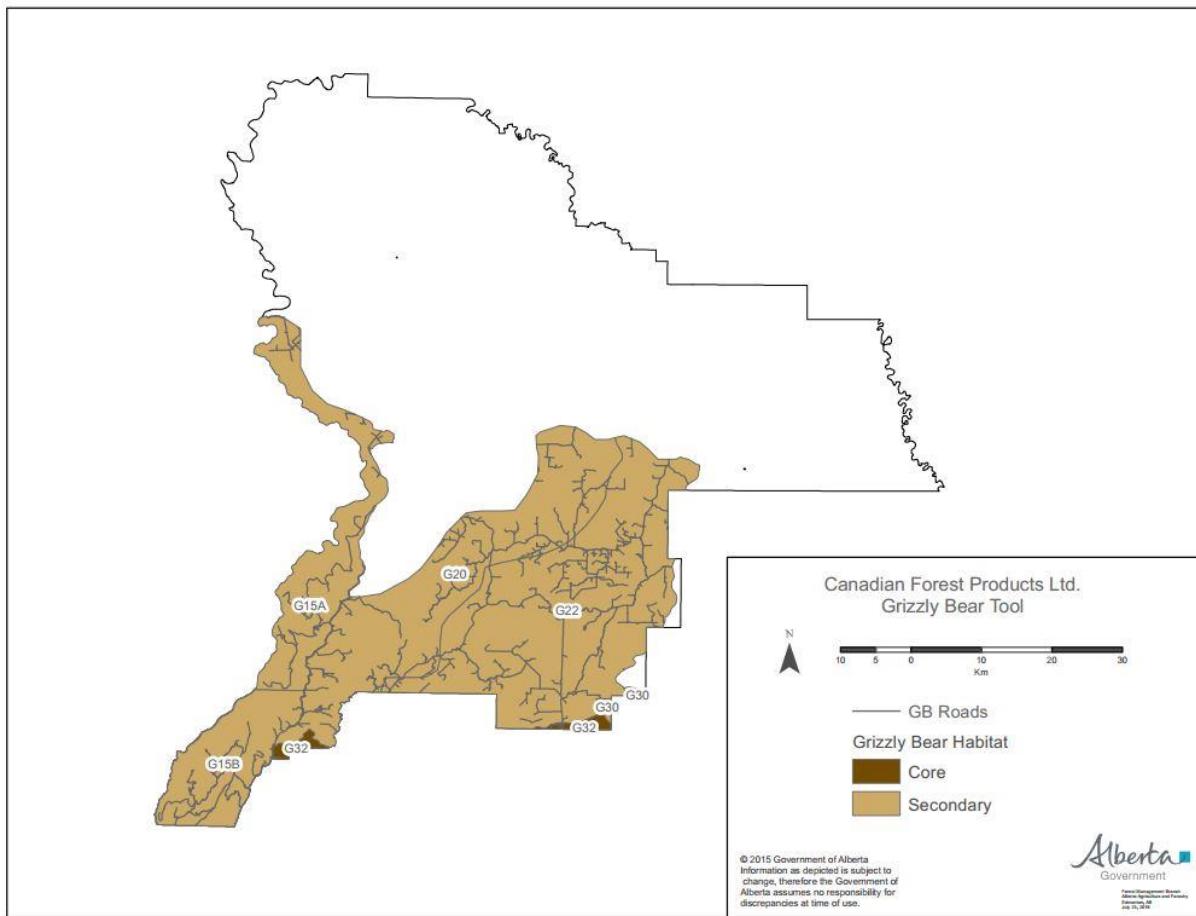


Figure 104 Canfor Roads in Grizzly Bear Core and Secondary Habitat (GoA, 2015)

The Foothills Research Institute Grizzly Bear Program (FRIGBP) initiated research to identify and model grizzly bear habitat and risk in relation to proximity to roads. The likelihood of grizzly bear occurrence increases in high quality habitat, and therefore, when located in proximity to a road, the likelihood of grizzly bear mortality correspondingly increases.

Nielsen and et al. developed a Habitat State Model that combines occurrence (RSF models) and risk models (identifying habitat security) to help identify habitat states based on quality and risk, as well as to compare these habitat states over time to identify areas of potential management concern. The research identified “indices of attractive sinks and safe harbor habitats, as well as five habitat states: non-critical habitats, secondary habitats (low quality and secure), primary habitats (high quality and secure), secondary sinks (low-quality, but high risk), and primary sinks (high quality and high risk)” (Nielsen, Stenhouse, & Boyce, 2006). The proportion of grizzly bear sources and sinks within an area serves as the baseline measure of overall habitat quality (FRI, 2014)

AESRD completed an assessment of grizzly bear habitat using the Habitat State model on the Grizzly Bear Watershed Units (GBWU) within the primary and secondary habitat areas of Canfor’s FMA area to provide a baseline measure of current habitat as well as to predict future grizzly bear habitat state based

on the Preferred Forest Management Strategy (PFMS) (GoA, 2015). The analysis found that there is elevated risk to grizzly bear habitat in GBMUs G15B, G20, and G22. Figure 105 depicts areas of potentially good quality habitat and resources for grizzly bears in the primary and secondary habitat areas of the FMA area using the grizzly bear Resource Selection Function (RSF) model. Figure 106 depicts the current grizzly bear risk based on roads in the primary and secondary habitat areas of the FMA area. Figure 107 is the result of combining the RSF model and risk model in the Habitat State model to identify areas that are currently contributing as habitat sinks and sources in the primary and secondary areas of the FMA area. The forecasted grizzly bear RSF, risk, and habitat states based on the PFMS can be found in the TSA document (Appendix J).

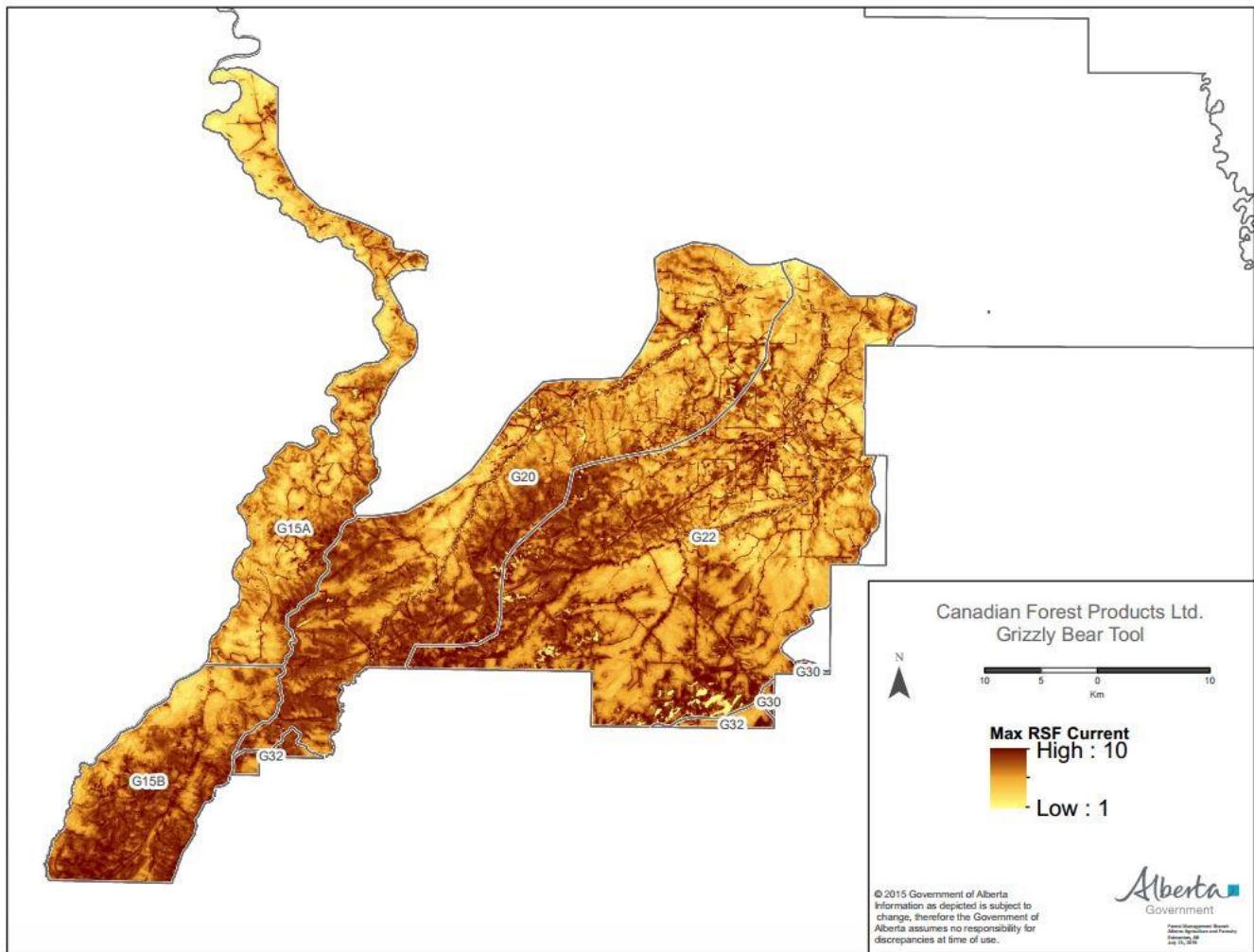


Figure 105 Current Grizzly Bear Habitat RSF

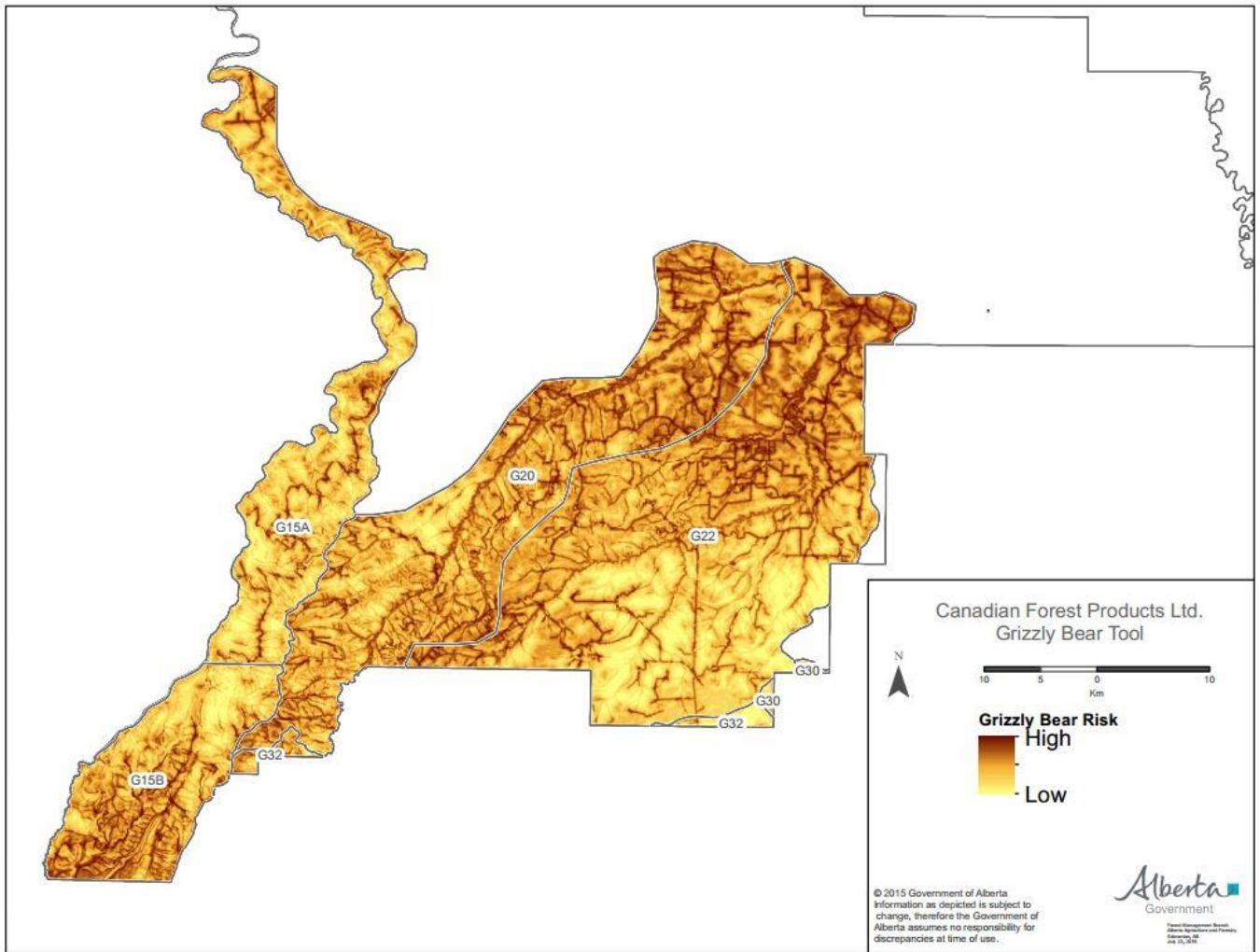


Figure 106 Current Grizzly Bear Risk

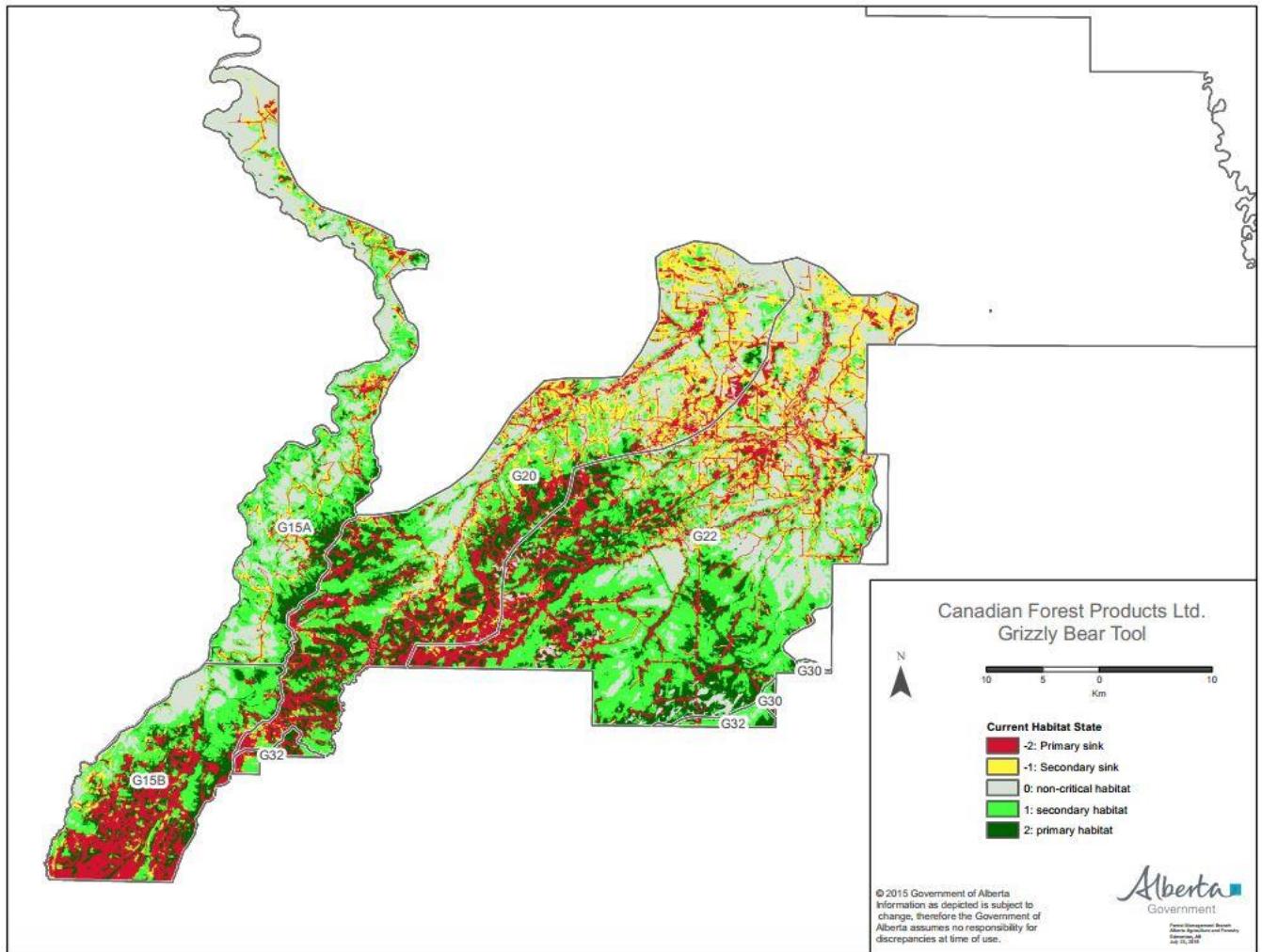


Figure 107 Current Grizzly Bear Habitat State (GoA, 2015)

Linkages to VOIT indicators and Associated Strategies

The following indicators from Canfor's 2012 Sustainable Forest Management Plan (Appendix H) (See Section 9 for correlation with Annex 4), and the implementation of the associated strategies will augment or complement the specific stand level management guidelines:

- 1.1.3b Patch Size
- 1.1.3c Seral Stage
- 1.1.4a Structural Retention
- 1.1.4b Riparian Management
- 1.1.4c Balancing Fibre and Ecological Factors in Burned Forests
- 1.2.2d Road Density

7.4.1.6.1.1 Mitigation Strategies

Best management practices are recommended to be undertaken in the GBWUs identified as having elevated risk (G15B, G20, and G22) based on the Habitat State Model analysis completed on Canfor's

FMA area (GoA, 2015). Implementation of best management practices within these areas of potentially higher risk will help ensure that habitat sinks are not increased and will support population persistence across the landscape. Canfor will develop plans at an operational level with AESRD to address the elevated mortality risk in the 3 GBMUs of concern. Through the development of the 2015 Forest Management Plan, Canfor and AESRD have identified the following stand-level best management practices and mitigation strategies that can be planned and implemented in the moderate and high GBMUs on Canfor's FMA area:

- Minimize new road placement near known important bear foraging areas;
- Coordinate access management to minimize potential human-grizzly interactions through implementing the Road Access Development Plan (RAD Plan) developed for that area and ensure that open road density thresholds of 0.6km/km² in the primary and 1.2km/km² in secondary grizzly bear habitat areas are not exceeded (Figure 103);
- If roads have been previously located near areas important for bear foraging, then permanently deactivate these roads when they are no longer required for access;
- Remove clover from grass seed mixtures when close to all season roads (<500 m) so that these areas are less attractive to grizzlies for foraging;
- Leave buffer strips of forested habitat to provide security cover and bedding areas adjacent to known important foraging areas (e.g., avalanche chutes, wet meadows, estuaries, streams/wetlands, skunk cabbage swamps, seeps and alder swales). These areas will often provide additional habitat elements such as mark trees and mark trails, as well as connectivity and escape cover;
- Where feasible, provide wind firm visual screening along all-season permanent roads to provide security cover;
- Avoid intensive silviculture treatments to address low stocked sites. This will result in a “patchy” stocking density that facilitates production of berry producing shrub species;
- Complete brushing activities within 5 years of initial establishment. If brushing is required after that time, use crop-tree centered brush treatments to maintain important forage species; and
- Signage to promote protection of grizzly bears and continue grizzly bear awareness education for employees, contractors, and the general public.

7.4.2 SITES OF BIOLOGICAL AND CULTURAL SIGNIFICANCE

It is important to maintain representative areas of naturally occurring and important ecosystems, rare physical environments, and sites of cultural significance across the landscape in addition to the course filtered approach to biodiversity that addresses habitat requirements for key focal species. Often, unique areas of biological and cultural significance are identified in the field during the planning phase or through consultation and are managed through avoidance.

7.4.2.1 Rare Plant Communities

Plant communities are groups of plants that share a common environment that interact with animals and the environment. Uncommon plant communities are important as to their rarity and unique biological significant to surrounding areas. Plants communities are usually defined by dominant plants species. To ensure conservation of biodiversity, uncommon plant communities occurring on the FMA

area may require special management considerations. The Alberta Conservation Information Management System website provides information on the type and potential location of uncommon plant communities (forested/woodland) plant communities. Since forest company operations are generally within the forested/woodland plant communities, it is important that employees and contractors are aware when completing activities in the forest. Canfor has created an Uncommon Forested/woodland Plant Communities manual which is used to train all applicable staff and contractors.

Indicator 1.1.1 from Canfor's *2012 Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), has been developed to ensure uncommon plant communities are maintained on Canfor's FMA area.

7.4.2.2 Wildlife Features

In addition to managing for specific habitat requirements for species of management concern, it is also important that key wildlife features are maintained on the landscape for other sensitive species. Sensitive sites relating to wildlife are identified in *Canfor's Operating Ground Rules* (Canfor, 2011b) and can include features such as natural mineral licks or wallows, raptor nest trees, nesting areas, bat hibernacula, natural springs, dens, and vernal pools.

Canfor is able to manage for key wildlife features at different levels. Identified natural mineral licks and trumpeter swan nesting sites and water bodies are removed from the available timber harvesting landbase that is used in the development of the FMP. In addition to this, other sites are dealt with operationally as they are identified on the FMA area; generally in the form of buffers as specified in *Canfor's Operating Ground Rules*.

The following indicators from Canfor's *2012 Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), have been developed to ensure that key wildlife features and sites of biological significance are maintained on Canfor's FMA area:

- 1.2.1b Mineral Licks
- 1.2.1a Trumpeter Swans
- 1.4.1b Sites of Biological Significance



Figure 108 Raptor Stick Nest

7.4.2.3 Historical and Cultural Sites

Historical and cultural sites are important indicators of the evolution of species, human development and traditional uses in the area. Canfor is committed to maintaining identified historical and cultural sites on the FMA area in order to continue to learn about the history of the region and to maintain important traditional use areas for local aboriginal communities.

Canfor is able to manage for historical and cultural sites at different levels of the forest management process. Known historical gravesites for example, are areas of cultural significance and are removed from the timber harvesting landbase that is used in the development of the FMP. Other historical and cultural sites that are identified through the consultation process or identified during archaeology surveys are dealt with on an operational level, generally in the form of buffers.

Indicators 1.4.2 and 6.2.1 from Canfor's *2012 Sustainable Forest Management Plan* (Appendix H) (See Section 9 for correlation with Annex 4), have been developed to ensure historical and cultural sites are maintained on Canfor's FMA area.

7.5 Natural Calamities

Natural calamities are stochastic and unpredictable events, which make them difficult to predict and manage. Most natural calamities will be dealt with as they occur on the FMA area. As described in Section 3.1.4.3, Mountain Pine Beetle (MPB) is the largest natural disturbance threat to the FMA area at this time. Canfor has worked to reduce the risk of a major MPB spread through implementation of the 2009 *Healthy Pine Strategy* (Canfor, 2009), in which Canfor targeted the removal of 75% of the highest susceptible pine. Canfor has modeled a similar approach in this FMP as described below.

7.5.1 MOUNTAIN PINE BEETLE STRATEGY

Canfor's current Healthy Pine Strategy (HPS) assumes no mortality or loss of MPB-affected stands. Harvest levels have kept pace with the expansion of the MPB infestation such that all stands are harvested before they become un-merchantable. Canfor intends to continue with this MPB strategy and will meet the intent of the planning standard outlined in "Appendix A" (AESRD, 2006a), which states that AACs will be revised if more than 2.5% of the net landbase is deleted.

If at the end of the fifth year the extent of the MPB infestation requires an adjustment to the approved AAC it will be done at the time or captured in the next FMP for the reasons stated below:

- 1) Canfor will continue to implement the MPB Interpretive Bulletin (AESRD, 2006b) and target 75% harvest of susceptible pine and infested merchantable stands as per the current *Healthy Pine Strategy*. Based on current analysis Canfor is expected to complete this within the first ten years of the planning horizon;
- 2) Canfor is able to utilize MPB dead merchantable stems within five years of infestation;
- 3) AESRD continue to carry out an effective level one program in the Active Zone of the FMA area with focus in the Caribou Range; and
- 4) Based on annual flights of Canfor's FMA area, it has been identified that few stands have been completely killed by MPB; where there are MPB infestations, the percentage of dead pine is very sporadic, which makes it difficult to apply one standard that fits all pine stands across the FMA area.

Canfor has made significant progress in implementing the *Healthy Pine Strategy* and through this has managed to drastically limit the spread of MPB throughout the FMA area. Based on this, the timber supply model includes a target ensuring the salvage of at least 75% of the susceptible pine volume over

the first ten years of the planning horizon and will not include any mortality assumptions resulting from MPB.

7.6 Reforestation Strategies

Canfor has adopted the following corporate Silviculture Mission:

“...to safely achieve legislated free growing standards in the most cost effective manner possible, while meeting certification, legal requirements and timber supply objectives at the landscape level.”

Canfor's *2015 Forest Management Plan Reforestation Strategy* (Appendix G) details the reforestation strategy that will be implemented to achieve the proposed regenerated yield projections in the 2015 Canfor Forest Management Plan. Outlined in the Reforestation Strategy and the associated Reforestation Strategy Table are activities applied to a harvested opening that should achieve crop tree (site index tree) survival, suitable productivity, and meet the proposed forest structure intended in the regenerating stand within the Reforestation Phase¹⁸.

7.7 Climate Change and Carbon Storage

7.7.1 PREDICTED CLIMATE CHANGE

Globally, climate change has created its footprint by changing forest structure, species composition, and more specifically, through increasing tree mortality (Bonan, 2008); (Allen, et al., 2010). Locally in Alberta, researchers have identified that landscape dynamics and natural disturbance regimes (e.g. forest fires and insect outbreaks) have been, and will be altered as a result of the changing climate (Li, Flannigan, & Corns, 2000); (Schneider R. , 2013). This makes climate change a definite factor to be considered in the forest management planning process (Van Der Meer, Jorritsma, & Kramer, 2002).

Canfor has completed an analysis on the projected impacts of climate change on the FMA area to identify any potential risks to the changing forest structure due to anticipated climate change (Huang, 2015). Points were placed in each of the Natural Subregions on Canfor's FMA area to be analyzed using the Climate WNA model (Figure 109). This model was used to project the future mean annual temperature (MAT) and mean annual precipitation (MAP) for the FMA area at key points in time. As depicted in Table 51, there is a very clear warming trend which on average may result in a seven degree temperature increase over time. It is predicted that MAP will continue to fluctuate and possibly even drop for some areas in the next 70 years. The results of this analysis support the theory that forests in the Boreal and Foothills Natural Regions will likely be impacted by climate change in the future, which may result in different forest structures than what we see today.

¹⁸ Reforestation Phase runs to the end of the 14th year after harvest.

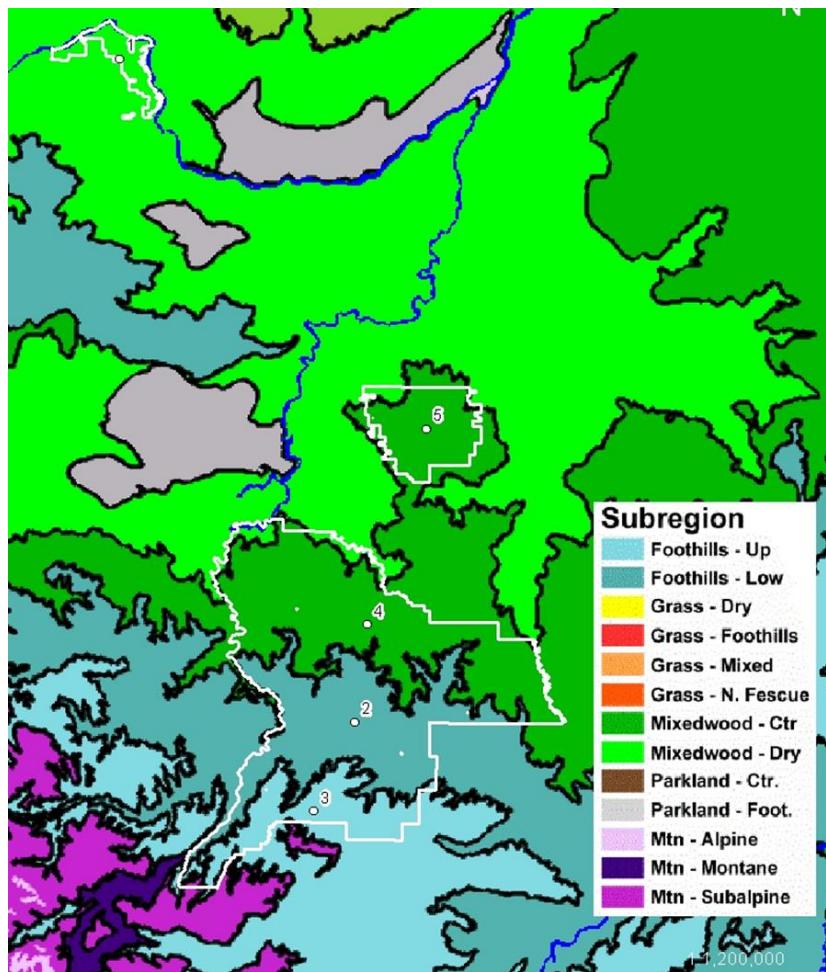


Figure 109 Locations for Climate WNA Model
Using the Basemap from Schneider's study (2013)

Table 51 Projected MAT and MAP by Location

Number	1961-1990	2025	2055	2085	1961-1990	2025	2055	2085
	MAT (°C)	MAT (°C)	MAT (°C)	MAT (°C)	MAP (mm)	MAP (mm)	MAP (mm)	MAP (mm)
1	0.5	2.6	5.1	7.9	501	517	529	521
2	2.4	4.3	6.6	9.2	651	662	673	662
3	2.4	4.4	6.6	9.2	702	711	718	702
4	2.2	4.1	6.4	9.1	618	631	642	632
5	2.2	4.1	6.5	9.1	618	538	550	542

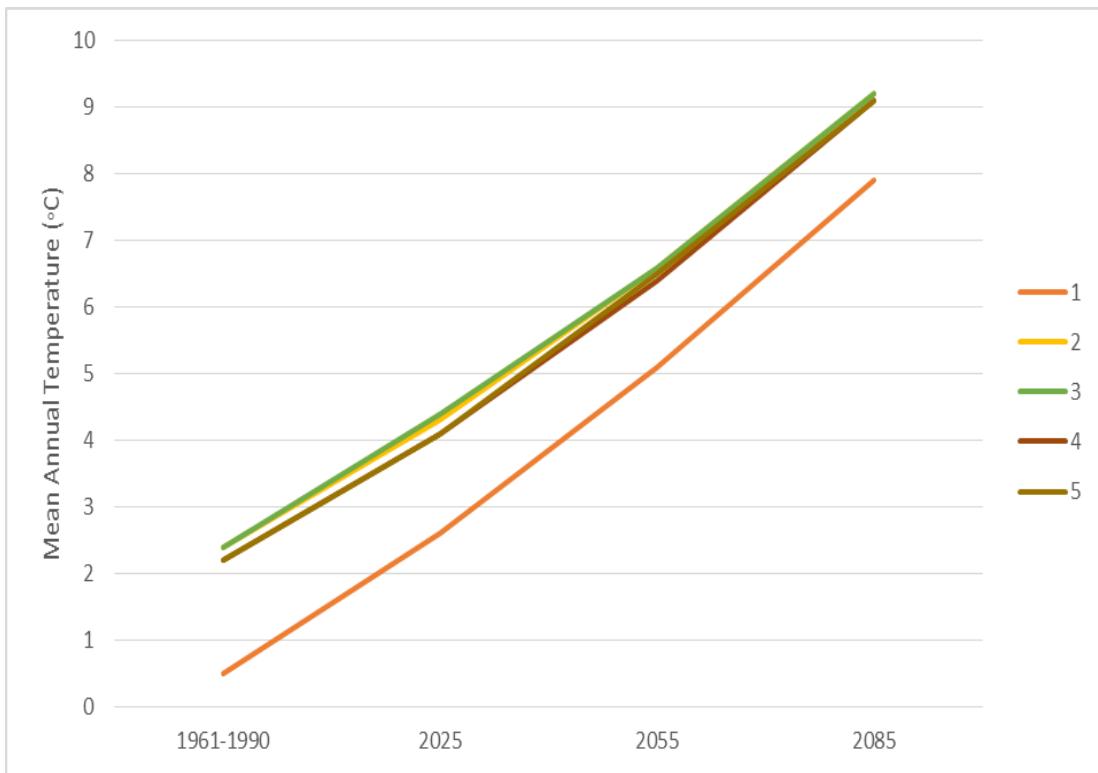


Figure 110 Mean Annual Temperature Projection for RCP 8.5 using HasGEM2 Model

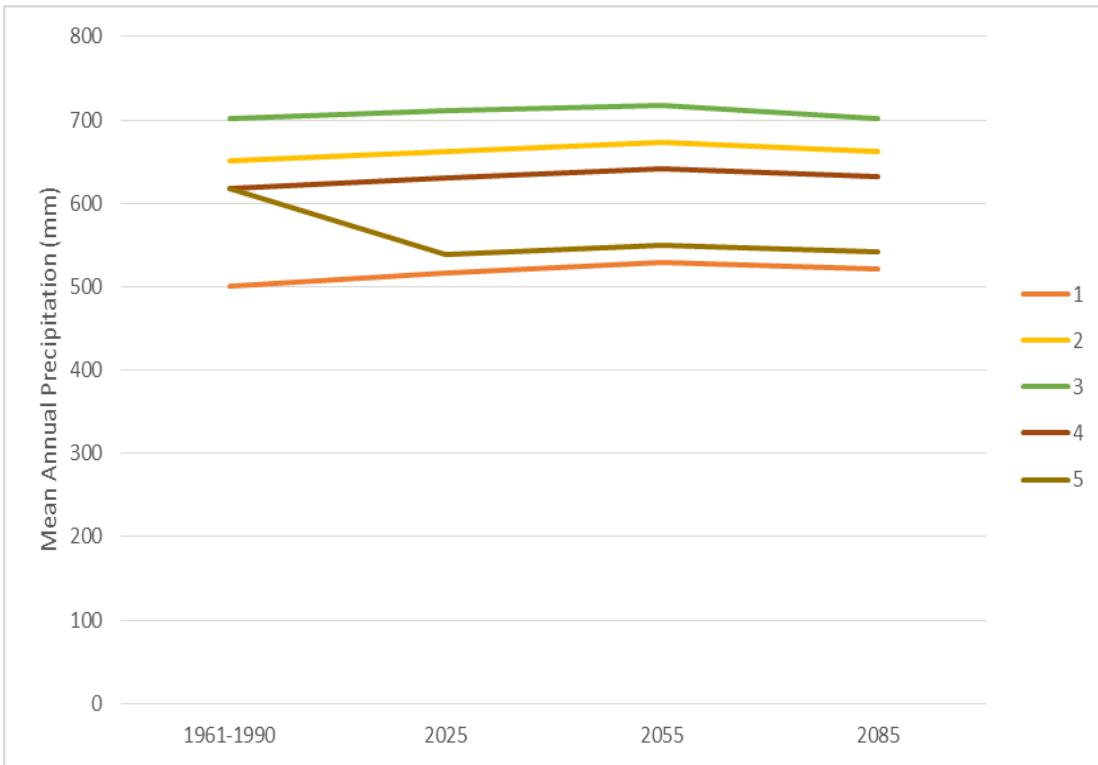


Figure 111 Mean Annual Precipitation for RCP 8.5 Using HasGEM2 Model

7.7.1.1 Climate Change Adaptation

The complexity and uncertainty of climate change limits the implementation of adaptation strategies on the FMA area. There is no consensus in the science community to quantify the exact implication of climate change towards forest management at such a relatively small scale; therefore, Canfor will continue to monitor climate change on the FMA area, keep abreast of developing research, and adapt as more information becomes available.

7.7.2 PREDICTED CARBON UPTAKE AND STORAGE

The ability of forest ecosystems to capture CO₂e, primarily carbon dioxide (CO₂) from the air, and store it in plants and soil makes forests an important factor in the global carbon cycle (Solomon, et al., 2007). When trees are harvested, carbon is continually stored through various wood products. Stinson et al. (2011) revealed that an average family single house in North America stores over 34 tons of CO₂. Therefore, an enormous amount of carbon is stored via residential buildings and non-residential buildings after harvesting.

As a company that actively operates on Crown land, there is a need for Canfor to monitor and model carbon sequestration levels. Canfor used the Carbon Budget Model – Canadian Forest Service (CBM-CFS3) developed by Natural Resources Canada to conduct stand-level and landscape-level modelling with same the operational constraints used in the timber supply analysis.

Forest Carbon

Ideally, a balance of carbon cycle is achieved through a balanced exchange between the biosphere and atmosphere (Falkowski, et al., 2000). In Canada, forests contribute to the carbon cycle as carbon sinks and carbon sources. Carbon sink occur when less carbon is released than absorbed; these are created in forests through photosynthesis. Carbon stored in the atmosphere as CO₂e is absorbed into trees (e.g. trunks, branches, leaves and roots) and soils. However, when forests are dying, either due to biotic (e.g. pest epidemic) or abiotic disturbances (e.g. forest fire), they become a carbon source that emit carbon into the atmosphere (Natural Resources Canada, 2007). If this balance is broke, climate change will occur (Cox, Betts, Jones, Spall, & Totterdell, 2000).

Many countries are trying to manage greenhouse gas emissions, which have resulted in the development of carbon accounting systems. Forest management is one option that can be used to reduce greenhouse gas emissions. In the past century, Canada's forests have generally been a carbon sink, achieved through forest growth and renewal of Canada's 310 million hectares of forests (Natural Resources Canada, 2007). In the past decade, however, this trend becomes less clear and more complex. Figure 112 shows that there were more CO₂e emission years than removal years between 2002 and 2012 (Environment Canada, 2014). This is mainly due to severe MPB infestations in Interior British Columbia and Alberta. The warming climate is likely to increase natural disturbance occurrences, especially in regards to forest fire and pest infestations (Kurz, et al., 2008); (Metsaranta, Kurz, Neilson, & Stinson, 2010). This is anticipated to result in more carbon emissions from forests in the future.

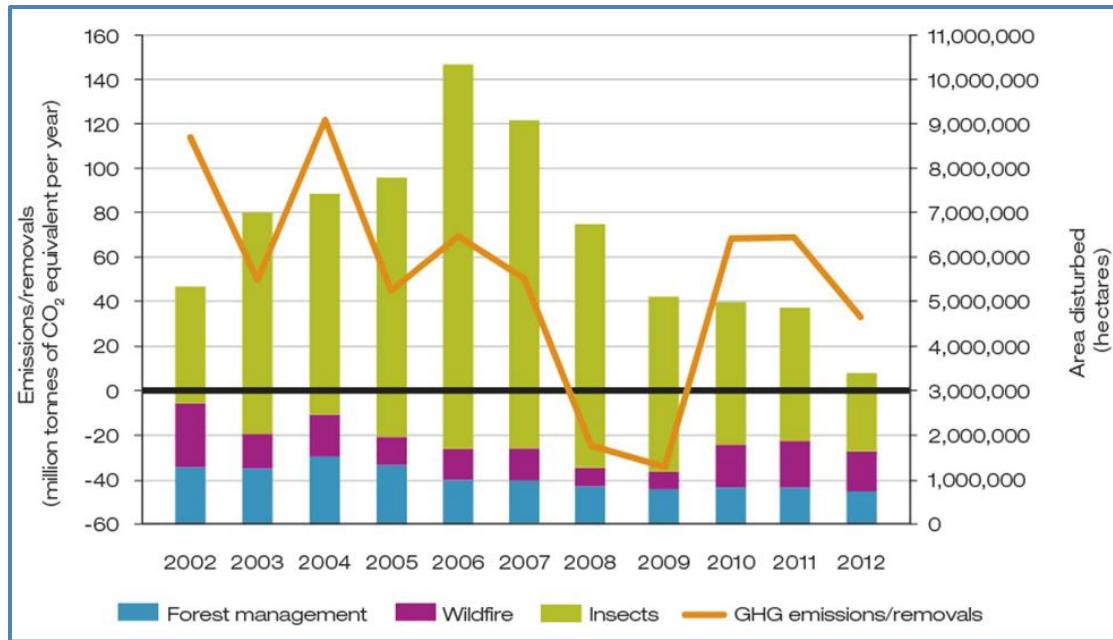


Figure 112 Forest Carbon Dynamics in Canada between 2002-2012

Source: (Environment Canada, 2014)

Forest Carbon Modelling Process

In order to mitigate and reverse this negative trend, there is a need to quantify forest carbon stocks for different levels of government and policymakers to monitor and develop associated regulations (Kurz, et al., 2009). Forest ecosystems are so complex and diverse that field measurements would never be enough (Running, et al., 1999). Therefore, modelling is the only feasible approach to estimate forest carbon stocks in various levels.

With its strong credibility and feasible operational usability, CBM-CFS3 was selected for Canfor's FMP analysis. CBM-CFS3 uses empirical yield curves for different species, to connect forest volume to forest carbon. The yield curves used are the same as those used for the FMP timber supply analysis. Figure 113 outlines the data input and processing flow when using CBM-CFS3. Similar to timber supply analysis, yield curves ("Volume/age curves") and Alberta Vegetation Inventory data ("Detailed forest inventory") are the main input requirements, and the spatial harvest sequence generated from the PFMS is used as the harvest schedule.

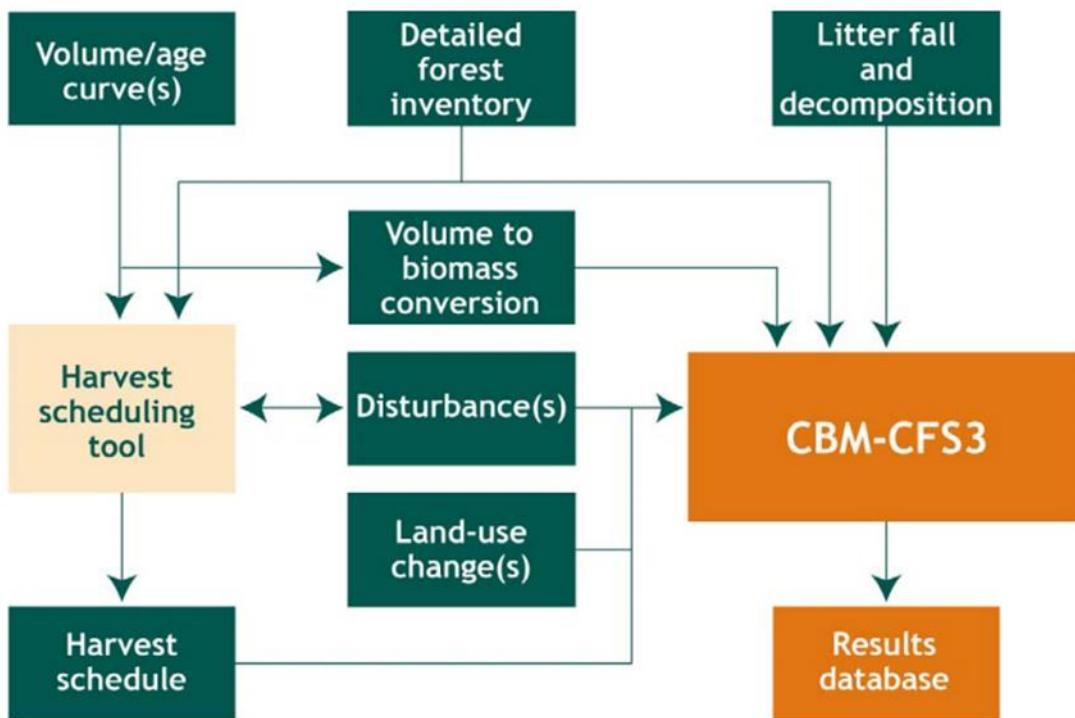


Figure 113 CBM-CFS3 Data Input and Processing Flow

Source: (Canadian Forest Service, 2013)

Since carbon is stored in different parts of the forest ecosystem, CBM-CFS3 breaks down the total ecosystem carbon projection into more detailed categories: aboveground biomass, belowground biomass, dead organic matter, and soil biomass. The various carbon sources are called “carbon pools”. Figure 114 shows the different carbon pools used by CBM-CFS3. According to this list, biomass for standing live timber, standing dead trees, underground roots, coarse woody debris, and soils are all taken into consideration for projection and estimation. The estimated results are very close to the ground truth of carbon stored in the forest.

CBM-CFS3 pool	Description
Merchantable + bark (SW or HW)	Live stemwood of merchantable size ^a plus bark
Other wood + bark (SW or HW)	Live branches, stumps and small trees including bark
Foliage (SW or HW)	Live foliage
Fine roots (SW or HW)	Live roots, approximately <5 mm diameter
Coarse roots (SW or HW)	Live roots, approximately ≥5 mm diameter
Snag stems DOM (SW or HW)	Dead standing stemwood of merchantable size including bark
Snag branches DOM (SW or HW)	Dead branches, stumps and small trees including bark
Medium DOM	Coarse woody debris on the ground
Aboveground fast DOM	Fine and small woody debris plus dead coarse roots in the forest floor, approximately ≥5 and <75 mm diameter
Aboveground very fast DOM	The L horizon ^b comprised of foliar litter plus dead fine roots, approximately <5 mm diameter F, H and O horizons ^b
Aboveground slow DOM	Dead coarse roots in the mineral soil, approximately ≥5 diameter
Belowground fast DOM	Dead fine roots in the mineral soil, approximately <5 mm diameter
Belowground very fast DOM	Humified organic matter in the mineral soil
Belowground slow DOM	

Figure 114 CBM-CFS3 Carbon Pools and Descriptions¹⁹

Source: (Kurz, et al., 2009)

7.7.2.1 Predicted Carbon Impacts

As described above, data used in the FMP timber supply analysis was used for carbon modelling. Figure 115 shows the carbon estimation over the 200-year planning horizon under the PFMS. As can be seen from the graph, the general trend for forest carbon is relatively stable. However, there is a 7.8% drop in the total forest carbon in the first century of the planning horizon. Specifically, from year 0 to year 50, which results in an approximate 1.3% decrease in carbon per decade. This decline is a result of a decrease in aboveground biomass, belowground biomass, and dead organic matter. Aboveground biomass has the most severe drop (24%) in the first 50 years. Figure 116 illustrates the comparison between the PFMS AAC and total ecosystem carbon levels across the planning horizon. It does not show a direct and simple correlation (positive or adverse) between harvesting and carbon sequestration. At year 50 for example, carbon stocks are still stabilized despite a 9.6% increase in the cut level at year 115. Possible explanations for this relationship include seral stage, previous cut levels, and natural disturbance.

¹⁹ SW= Softwood; HW=Hardwood; DOM= Dead Organic Matter

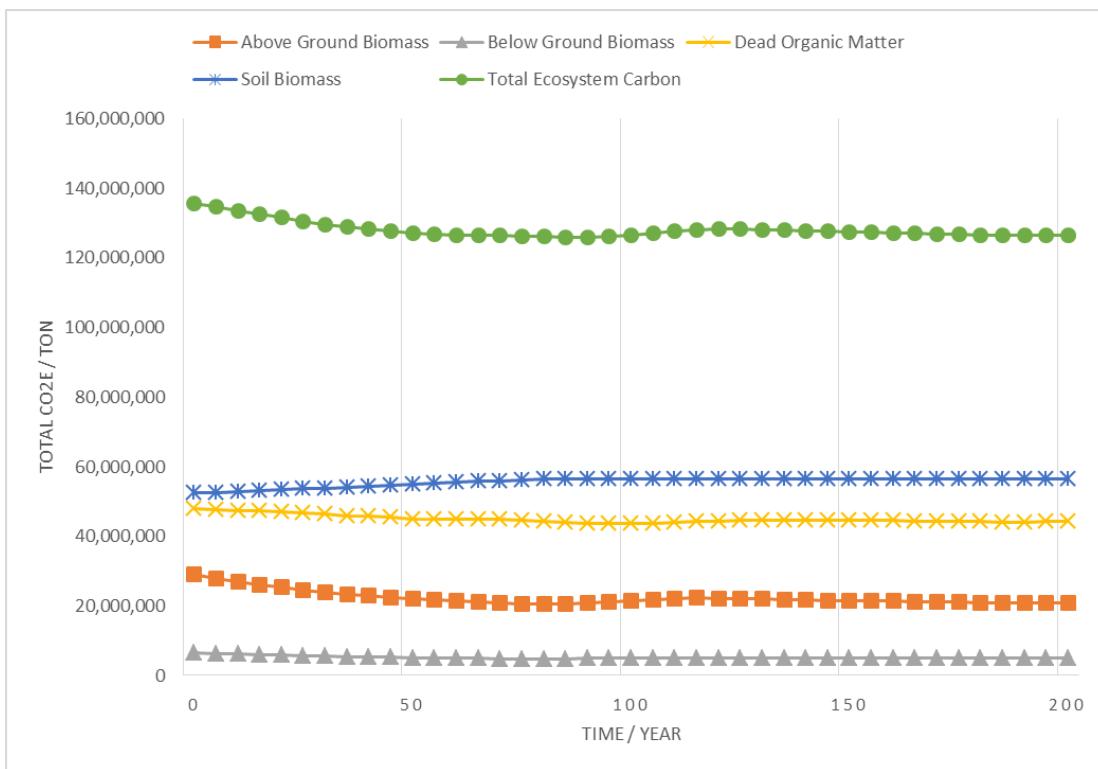


Figure 115 200-Year Forest Carbon Projection for Canfor PFMS

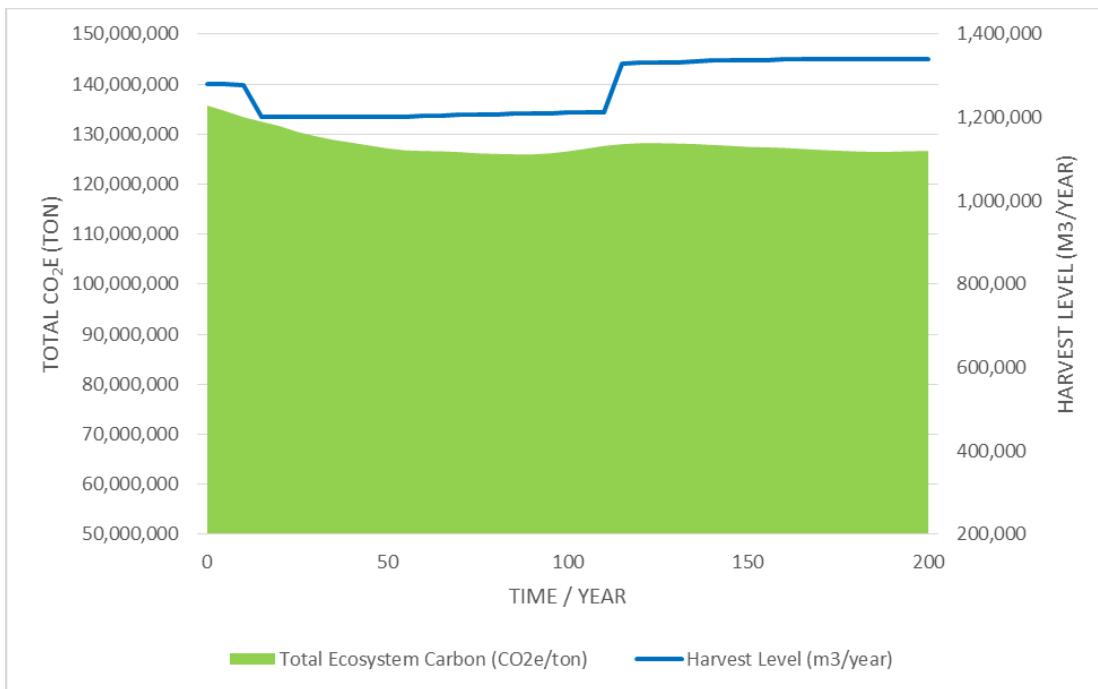


Figure 116 200-Year Forest Carbon Projection versus 200-Year Cut Level Projection

Seral Stage

There is a consensus that mature forests have higher abilities to store carbon than young and old growth forests (Swift & Cuzner, 2013). Pioneer and young forests have the highest growth rate and the best potential to be a carbon sink, but the carbon stored permanently on site (coarse woody debris, leaf, litter, and soil) is less. Old growth forests are considered carbon neutral due to limited growth and decay rates (Covey & Orefice, 2009).

Harvesting in the first rotation results in a decrease in the amount of mature and over mature age classes. After year 50, the second rotation of forests become available for harvest. The seral stages for managed forests gradually change to young and mature dominant stands and the mature age class, which sequesters the most carbon, bounds back and becomes either the dominant or co-dominant age class in two regions. The carbon stock projection supports this age class shift, and will become stable for the remainder of the planning horizon.

Previous Cut Levels

Harvesting operations have a direct influence on forest carbon sequestered on site. Carbon can be transferred to other locations or emitted back to the atmosphere (Stinson, et al., 2011). In general, the correlation is converse, meaning that the higher the harvest level is, the less carbon preserved on site (Bradford, 2011); (Seedre, Taylor, Brassard, Chen, & Jogiste, 2014). However, this appears not to be the case for the FMA area. Figure 117 demonstrates the actual volume harvested (both conifer and deciduous) prior to year 0 (2014) of the planning horizon. Actual volume harvested is less than the approved AAC, largely in part to an inactive mill for one of the deciduous timber quota holders. On average, the actual deciduous harvest level was 54% below the approved AAC in the 15 years prior to planning year 0. In the projected AAC for the PFMS, a full deciduous cut level has been allocated to both of deciduous timber quota holders. Accordingly, there is a hike in the future harvest level at year 0 compared to previous levels as illustrated in Figure 117. The increased harvest level explains the converse correlation between cut level and carbon stocks on site. Nevertheless, as the conclusion from seral stage analysis stated, the forest will be dominated by the young and mature age classes during the first rotation, but carbon stocks will eventually stabilize, even with a cut level increase at year 115.

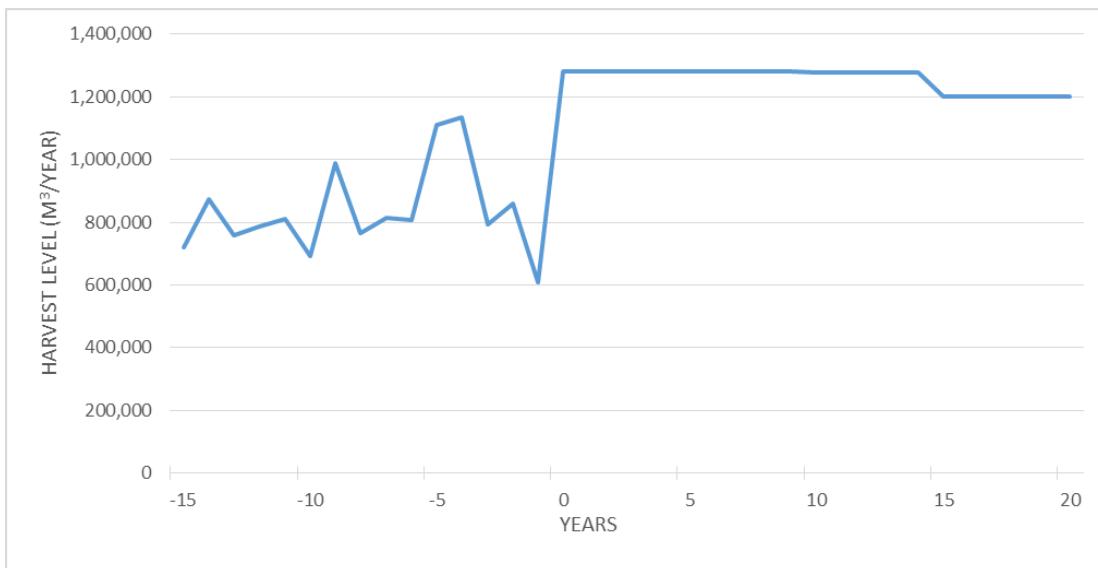


Figure 117 Actual Cut Level (Coniferous and Deciduous) and Modelled Annual Allowable Cut for the FMA Area

Uncertainty-Natural Disturbance

It is still not very clear whether increasing global warming trends will make forests a carbon sink or carbon source (Field, Lobell, Peters, & Chiariello, 2007); (Luo, 2007); however, two main factors have been and will have impacts on future Canadian forest carbon sequestration: pest infestation and wildfire [(Kurz, et al., 2008); Metsaranta *et al.*, 2010; (Environment Canada, 2014)].

Outbreaks from biotic agents usually cause tree mortality and climate change, which will likely result in further infestations (Dale, et al., 2001); (Kurz, et al., 2008); (Allen, et al., 2010); (Bentz, et al., 2010). The increasing occurrence of forest pest induced tree mortality not only decreases the carbon storing capacity, but also emits carbon back into atmosphere from decaying dead trees (Kurz, et al., 2008).

As demonstrated in Figure 112, MPB infestations are mainly responsible for making Canadian forests almost carbon neutral in the past decade [(Environment Canada, 2014); (Kurz, et al., 2008)].

Similar to biotic disturbance, wildfire also directly affects forest carbon stocks. Successful forest protection programs accumulate an extensive amount of fuel in the forests. This changes the natural range of variability and modifies the likelihood, severity, and intensity of forest fire (Morgan, et al., 1994); (Holling & Meffe, 1996); (Moore, Covington, & Fulé, 1999); (Wong & Iverson, 2004). Burning can cause direct carbon emission from trees into the atmosphere and could cause a large reduction in carbon storage if a severe fire were to occur in managed forests (Amiro, Cantin, Flannigan, & Groot, 2009); (Balshi, et al., 2009). Nevertheless, latest research has shown that there is no significant difference in terms of total ecosystem carbon at stand initiation and development stage between harvesting and fire (Seedre, Taylor, Brassard, Chen, & Jogiste, 2014).

7.7.2.2 Carbon Credit Market Potential

Forest carbon not only has important ecological functions, but also has the opportunity to be a viable business. The government of Canada and the government of Alberta have set a series of targets and

regulations around greenhouse gas emissions (AESRD, 2015a); (Environment Canada, 2015a). In order to achieve greenhouse emission reduction targets, large emitters (defined as emitters that release more than 100,000 tonnes of greenhouse gases) are looking for various carbon offset projects to purchase carbon credits. A forest carbon project is one of the lowest cost options (Galik & Jackson, 2009). Due to the increasing public perception of climate change and tightened federal and provincial legislation and regulations, this is a business potential that is worth exploring for FMA holders in Alberta.

The basis for carbon credits is that the organization needs to demonstrate above and beyond baseline business practices without carbon leakage anywhere else (AESRD, 2011a). Depending on whether the facilities or activities are regulated under the *Climate Change and Emissions Management Act* and *Specified Gas Emitters Regulation*, there are two types of credits available for the forest industry through the Alberta-based offset credit system: 1) offset credits; and emission performance credits (AESRD, 2010b). Offset credits can be awarded if the facility and reduction activities are not covered by the *Specified Gas Emitters Regulation*; emission performance credits can be obtained through facility and reduction activities that are covered by the *Specified Gas Emitters Regulation*. Canfor's Biomass Energy Project in Grande Prairie Sawmill has registered with the Alberta Offset Registry under emission offset projects (Alberta Offset Registry, 2015).

In the scope of this FMP, Canfor has not developed a proposal, but will continue to explore and monitor the business potential of enhanced forest management activities in the Alberta-based offset credit system.



8 Timber Supply Analysis

Canfor's Forest Management Plan (FMP) for the Grande Prairie Forest Management Agreement area (FMA) # 9900037 requires a timber supply analysis (TSA) to guide forest management decisions. Canfor's FMP vision is to provide a forest management plan framework for crown lands under Canfor's tenure in Alberta that maintains the ecological integrity and biological diversity of forests while being socially acceptable and economically viable. The TSA will address multiple forest values, non-forest values, and landscape features that reflect these ecosystem-based guiding principles.

For the Grande Prairie FMA area, the FMP was developed in accordance with the Alberta Forest Management Planning Standard (April 2006, Version 4.1) which provides a guide for determining the contributing landbase available for timber harvesting.

Landbase assignment defines the landbase available for timber harvesting on the FMA area. This assignment is based on the forest management planning standard, operating ground rules, the most up-to-date landbase exclusions, and economic and technical considerations. The landbase assignment reflects the cooperation of three forest companies possessing timber rights within the FMA area: Canadian Forest Products Ltd. (Canfor); Tolko Industries Ltd. (Tolko); and Norbord Incorporated (Norbord), with consultation with AESRD.

The Landbase Assignment document was originally submitted May 30th, 2012 at which time the timber supply analysis was initiated. Due to delays resulting from the development of the Little Smoky and A La Peche Caribou Range Plan, the Landbase Assignment document was updated and re-submitted July 31st, 2014 (Appendix F) and agreement in principle was received from AESRD on September 11th, 2014.

Ecora Engineering and Resource Group provided the analytical and inventory services for the TSA. Ecora used Patchworks, which is a spatially explicit harvest scheduling optimization model, as the tool for the analysis. It was used to develop spatially explicit harvest allocations that explored the tradeoff between a broad range of conflicting management and harvest goals.

Management alternatives that address the values, objectives, indicators and targets were evaluated based on a series of Patchworks runs that use preliminary goals and constraints as established by the FMAC and PDT. A final run was conducted so that the final management alternatives could be selected. AESRD through the PDT process was presented with the results at critical stages and has been kept informed as the analysis proceeded.

The process involved extensive consultation with the public, other resource users, other stakeholders, and the government. Balancing the competing objectives of these groups is a very complex process. On the basis of this evaluation and consultation, the scenario that best met non-timber and timber objectives was selected as the Preferred Forest Management Scenario (PFMS). This strategy is preferred because it is the one that best meets all of the objectives (environmental, social, and economic). The



PFMS results in sustainable coniferous and deciduous wood-flows. These harvest levels are achieved while assuring that non-timber resources are also maintained across the 200-year planning horizon.

The results of the TSA show that a coniferous harvest (annual allowable cut) of 714,104m³/year is achievable in the first 10-years to meet MPB objectives. This level of coniferous harvest will support a deciduous annual allowable cut (AAC) of 564,299m³ in the first 10-years to account for unused reconciliation volume from previous years, followed by a sustainable AAC of 490,000m³ after that.

The 2015 Forest Management Plan Timber Supply Analysis Report is provided in its entirety in Appendix J.

9 Values, Objectives, Indicators, and Targets

9.1 Background Information

The CSA requirement to develop a Sustainable Forest Management Plan (SFMP) that applies specific performance objectives and targets over the FMA area creates a strong link to *Annex 4* of the *Alberta Forest Management Planning Standard* (AESRD, 2006a). The development of the VOITs for Canfor's *2012 Sustainable Forest Management Plan* (Canfor, 2014a) were found on four guiding documents:

- 1) The CAN/CSA Z809-08 Standard (CSA, 2008);
- 2) Canfor Corporate Indicators prepared under the CSA Z809-08 Standard (Canfor, 2011c);
- 3) The Alberta Forest Management Planning Standard, Annex 4 VOITs (AESRD, 2006a); and
- 4) The Canfor Grande Prairie 2005 VOITs prepared under the CAN/CSA Z809-02 Standard (Canfor, 2005).

As a means to strengthen Canfor's commitment to SFM, the SFMP is incorporated into the FMP as a way to link the values, objectives, indicators, and targets set out in the SFMP to the strategic vision and operational strategies set in the FMP. Wherever possible, Canfor linked the VOITs developed in the SFMP with the required VOITs in Annex 4 (Table 53). All background information, current status, and future projections for these VOITs as they apply to the FMP and SHS can be found in Canfor's *2012 Sustainable Forest Management Plan* (Appendix H).

Since Canfor's SFMP and AESRD's Annex 4 VOITs (AESRD, 2006a) are based on different CSA standards not all VOITs could be directly linked. Three additional VOITs have been created specific to Annex-4 requirements and are described in Section 9.1.1. Canfor also has ten additional VOITs in its 2012 SFMP that are not related to Annex 4 (Table 52).

Table 52 Additional Canfor VOITs not in Annex-4

Canfor VOIT #	Indicator	Target
1.1.2	Percent distribution of forest type (treed conifer, treed broad leaf, treed mixed) >20 years old across DFA	Maintain the current baseline percent distribution of forest types (treed conifer, treed broad leaf, treed mixed) >20 years old into the future
5.2.2	Training in environmental and safety procedures in compliance with company training plans	100% of Canfor FMG Alberta employees and contractors have required environmental and safety training
5.2.3	Level of direct and indirect employment	Report annually on trend of Canfor Alberta's level of direct and indirect jobs created from the Defined Forest Area
5.2.4	Opportunities for Aboriginal communities and contractors to participate in the forest economy	Maintain evidence that opportunities have been provided
6.1.1	Canfor FMG Alberta employees will receive Aboriginal awareness training	100% of Canfor FMG Alberta Forestry Supervisors, Coordinators, Superintendents, and the Operations Manager will receive credible and effective Aboriginal awareness training once
6.3.1	Relationships with other forest businesses and users	Evidence of minimum of 4 relationships with forest products businesses annually within the vicinity of the DFA
6.3.2	Implementation and maintenance of a certified safety program	100% of Canfor FMG Alberta and eligible DFA-related contractors will obtain and maintain a Certificate of Recognition or equivalent
6.3.3	Implementation and maintenance of certified safety program	100% of recommendations from Partners in Injury Reduction audit will be addressed and action plans developed
6.5.2a)	CSA Z8909-08 SFM monitoring report made available to the public annually	CSA Z809-08 Sustainable Forest Management Plan and Annual Performance Monitoring report made available to public annually on Canfor's external website
6.5.2b)	Percentage of public inquiries that receive an initial contact	100% of all inquiries receive initial contact within 1 month of receipt



Table 53 Canfor Values, Objectives, Indicators, and Targets

ESRD Planning Standard Annex 4					Canfor VOITs									
CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Canfor SFMP VOIT #	Indicator	Target	Means to Identify Target	Legal/Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
1. Biological Diversity	1.1 Ecosystem Diversity Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the DFA	1.1.1 Landscape scale biodiversity	1.1.1.1 Maintain biodiversity by retaining the full range of cover types and seral stages ³	Area of old, mature, and young forest in each DFA subunit ⁴ by cover class ⁵	1.1.3 (c)	Percent of area of pioneer, young and old forest by Natural Region will meet the Preferred Forest Management Scenario forecast	100% of pioneer, young and old forest by Natural Region across the DFA	Seral stage targets are based on the natural range of variation (NRV) and the assumption that all native species and ecological processes are more likely to be maintained if managed forests are made to resemble forests created by natural disturbance agents, such as wildfires. Analysis of the effects of different fire return intervals on seral stage targets using Spatially Explicit Landscape Event Simulator (SELES) model.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.1.1	SHS	Actual harvest levels will be compared to the Spatial Harvest Sequence of the Preferred Forest Management Scenario forecasts every 5 years	FMP: Tables of projections at 0, 10, 50, 100 and 200 years; and maps of projections at 0, 10, and 50 years by Natural Region by Cover Class. Performance: Stewardship Report and Canfor Annual Performance Monitoring report	+/-20% of the Preferred Forest Management Scenario 10 year forecast	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
			1.1.1.2 Maintain biodiversity by avoiding landscape fragmentation	a) Range of patch ⁶ sizes by subunit and entire DFA	1.1.3 (b)	Range of patch sizes by subunit and entire DFA	Patch size distribution will achieve natural patch size distribution levels over the 200 year planning horizon	Patch size distribution targets were derived for the Boreal Forest and Foothills Natural Regions based on theoretical fire-return intervals (ORM. 2000). Targets for the Boreal Forest Natural Region were derived from measured patch size classes of four 20-year periods of unmanaged forests (Tanner, D. a. 1996); while targets for the Foothills Natural Region were based on the distribution of patch sizes in historical pre-suppression air photos of the Foothills Model Forest in Hinton, Alberta (Andison, 1997).	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.1.2a	SHS	The timber supply model forecasts the area of old interior forest by Natural Region from the Preferred Forest Management Scenario. Checks will be completed every 5 years to verify trend towards meeting predicted levels.	FMP: Tables of area of forest in each patch size class by subunit at 0, 10, and 50 yrs. (or end of first rotation). Maps of patch size classes at 0, 10, and 50 yrs., (or end of first rotation). Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	+/-10% of the Preferred Forest Management Scenario 10 year forecast	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
			b) Area of old interior forest ⁷ of each cover class by subunit and entire DFA	1.1.3 (a)	Area of old interior forest by natural region by cover class across the DFA	100% of area of old interior forest will be within the 10 year forecast by Natural Region	The amount of old interior forest is derived from the approved forest cover database (Alberta Vegetation Inventory) and a Geographical Information System (GIS) algorithm to extract the data. This initial level is used as a target for the remainder of the 200-year planning horizon.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.1.2b	SHS	The timber supply model forecasts the area of old interior forest by Natural Region from the Preferred Forest Management Scenario. Checks will be completed every 5 years to verify trend towards meeting predicted levels	FMP: Maps and Tables of indicator at 0, 10, and 50 yrs. Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	Area of old interior forest will not be less than 90% of the 10 year forecast by Natural Region of each cover class	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.	
			1.1.1.3 Maintain biodiversity by minimizing access	Open all-weather forestry road density by subunit	1.2.2 (d)	Density (lineal km/ km ²) of open (License of Occupation and Temporary non-reclaimed) roads	Density of open roads (lineal km/km ²) not to exceed 0.6 km/km ² for the primary Grizzly Bear Range and Caribou Range and 1.2 km/km ² for the remainder of the Defined Forest Area parcels (Main, Puskawakau & Peace) and secondary Grizzly Bear Range	The basis for the target is to minimize the footprint as it relates to roads and to align with an already identified target as indicated by research completed by Boulanger and Teahouse (The Impact of Roads on Demography of Grizzly Bears in Alberta, December 22, 2014). The same road density target for Caribou has also been identified in the Berland Smoky Regional Access Development Plan (October 14, 2011).	Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard; Federal Species at Risk Act; Alberta Wildlife Act	SHS and integrated land management with government and energy sector, including road deactivation and access restriction	Annually update the road data layer for the DFA for forestry and other industrial roads	FMP: Table of road density by subunit. Map of existing and proposed open and closed all weather roads. Report forestry roads and total (all users) roads. Performance: Stewardship Report	Road density will not exceed 0.66 km/km ² in the primary Grizzly Bear and Caribou Range and 1.2 km/km ² in the remainder of the DFA	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, this will be communicated to Environment and Sustainable Resource Development and course of action will be determined.



ESRD Planning Standard Annex 4					Canfor VOITs									
CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Canfor SFMP VOIT #	Indicator	Target	Means to Identify Target	Legal/Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
				Open seasonal / temporary forestry road length by DFA	None	Open seasonal / temporary forestry road length by DFA	Density of open seasonal/temporary forestry roads (lineal km/km ²) not to exceed 0.15 km/km ² across the Defined Forest Area	The basis for the target is to minimize the footprint as it relates to open seasonal/temporary forestry roads. Minimizing the industrial footprint on the landscape through strategic road planning and prompt reclamation will maintain biodiversity by reducing access to areas from the public, habitat fragmentation, and impacts to water quality and quantity.	Same as above target	Same as above target	Same as above target	FMP: Table of road density by DFA. Map of existing and proposed open and closed all weather roads. Report forestry roads and total (all users) roads. Performance: Stewardship Report	Open seasonal/temporary forestry road density will not exceed 0.2km/km ² across the DFA	Same as above target
		1.1.1.4 Maintain plant communities uncommon in DFA or province	Area or occurrence of each uncommon plant community within DFA	Uncommon (Forest/Woodland) plant communities maintained	1.1.1	100% of identified uncommon (Forest/Woodland) plant communities will be maintained	The Alberta Conservation Information Management System website provides information on the type and potential location of uncommon (forest/woodland) plant communities. www.tpr.alberta.ca/parks/heritageinfocentre/default.aspx	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.1.4	Mapping of potential locations, training in identification, and development of protection strategies for identified sites.	A list demonstrating that Final Harvest Plans were compared to Alberta Conservation Information Management System classification and mapping for potential overlap will be maintained	FMP: Table with descriptive list and targets. Map(s) displaying known locations of uncommon plant communities. Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; 100% of identified uncommon (Forest/Woodland) plant communities will be maintained	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.	
		1.1.1.5 Maintain unique habitats provided by wildfire and blowdown events	Area of unsalvaged burned forest	Area of unsalvaged burned forest	1.1.4 (c)	100% of burned areas that have salvage plans will be implemented in conformance with Alberta Environment and Sustainable Resource Development's Directive	Alberta Environment and Sustainable Resource Development, Forest Management Branch, Directive 2007-1 (ESRD. 2007b) (or its successors) directs salvage plans and the retention required depending on burn size.	Alberta Environment and Sustainable Resource Development, Forest Management Branch, Fire Salvage Planning and Operations Directive 2007-1 (ESRD. 2007b); Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.1.5a	Fire histories are obtained from the Province. Alberta, Environment and Sustainable Resource Development, Forest Management Branch, Fire Salvage Planning and Operations Directive 2007-1 (ESRD. 2007b); Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.1.5a	Fire histories are obtained from the Province. All fires larger than 10 hectares in merchantable stands will be reported in the Annual Performance Monitoring Report. The Province will not approve salvage plans if they do not meet the Directive therefore; approval of the Salvage Plan denotes that the Directive was followed. All burned areas planned for salvage operations will have approved Salvage Plans.	FMP: Table and map of natural disturbances within the last 10 years -salvaged and unsalvaged. Report area (ha). Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; 100% of burned areas that have salvage plans will be implemented in conformance with ESRD's Directive	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.	
			Area of unsalvaged blowdown	Area of unsalvaged blowdown	1.1.4 (d)	In areas with significant blowdown (>10ha), a minimum of 25% of the area will be left un-salvaged	Salvaging areas of blowdown timber to maintain forest growth include the retention of some area to remain for plants and animals that rely on blowdown/course woody debris for habitat	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.1.5b	Salvage plans will ensure that at least 25% of the cumulative area is not salvaged.	Staff or government may identify areas of blowdown during their field duties. All areas larger than 10 hectares will be tracked and summarized.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; A minimum of 25% of blowdown areas will be left un-salvaged	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.	
		1.1.1.6 Retain ecological values and functions associated with riparian zones	Compliance with OGR	1.1.4 (b)	Number of non-compliances where forest operations are not consistent with riparian management requirements as identified in operation plans (same metric as for 3.2.2.1)	Zero non-compliances, specific to Operating Ground Rules, with riparian management requirements in forest operations	Operating Ground Rules infractions involving riparian areas reported to the Province, or found by the Province will be reported.	Timber Management Regulations; Canfor Forest Management Agreement area Operating Ground Rules; Federal Fisheries Act; Water Act; and Alberta Forest Management Planning Standard, Annex 4 – Performance Standards	Block and road layout prior to harvest requires the identification of all riparian areas (as per Operating Ground Rules). Operating and road maintenance plans will include operational strategies for riparian areas.	Self-reporting, Internal/External audits, final harvest inspections, and Forest Operations Monitoring Program.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	Zero non-compliances, specific to Operating Ground Rules, with riparian management requirements in forest operations	Remediation of any outstanding issues is the first priority. All incidents are investigated. Root cause analysis is conducted where the cause is not clear. Strategies and procedures will be modified where appropriate.	



ESRD Planning Standard Annex 4					Canfor VOITs									
CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Canfor SFMP VOIT #	Indicator	Target	Means to Identify Target	Legal/Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
		1.1.2 Local/stand scale biodiversity	1.1.2.1 Retain stand level structure	a) % area / volume / stems residual structure (both living and dead), within a harvest area, representative of the status (live / dead), sizes, and species of the overstorey trees by subunit and entire DFA	1.1.4 (a)	Percent of representative merchantable area of the total annual harvested area retained as structure retention across the Defined Forest Area	On a 5 year rolling average, no less than 4% of the area (ha) harvested will be retained as representative merchantable un-harvested and dispersed structure retention across the Defined Forest Area	Based on ecological considerations, local knowledge, and recommendations from ESRD specialists	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards; Occupational Health and Safety Act; and Forest and Prairie Protection Act.	The design and layout phase will identify planned retention. The retention areas will be classified as non-merchantable and merchantable for the purpose of calculating area retained.	The amount of structure retained on harvest areas will be measured annually by using GPS technology or interpreted digital imagery.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No less than 3.0% of the 5 year rolling average harvested area (ha) will be left un-harvested as representative structural retention	Adjust activities
				b) Percentage of harvested area by subunit with downed woody debris equivalent to pre-harvest conditions	3.1.2	Percentage of harvested area by subunit with coarse woody debris equivalent to pre-harvest conditions	100% of subunits (Peace, Puskwaskau and Main) will meet or exceed coarse woody debris conditions equivalent to the pre-harvest state	Pre-harvest levels were determined by localized data collected from Canfor's 1997 temporary sample plot program.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.1.2.1b	Harvesting operations will retain coarse woody debris throughout the block.	Ocular to verify presence or absence of coarse woody debris as outlined in "Canfor Coarse Woody Debris Best Management Practices Appendix 7"	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; 100% of subunits (Peace, Puskwaskau and Main) will meet or exceed coarse woody debris conditions equivalent to the pre-harvest state	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
			1.1.2.2 Maintain integrity of sensitive sites	Sensitive sites (e.g. mineral licks, major game trails) by subunit and entire DFA	1.2.1 (b)	Percentage of significant wildlife mineral licks conserved	100% of significant wildlife mineral licks will be conserved annually, consistent with Operating Ground Rules	Canfor Forest Management Agreement area Operating Ground Rules state the required protection parameters; Alberta Forest Management Planning Standard, Annex 4 – Performance Standard 1.1.2.2	Management activities include identification, verification and buffering of significant wildlife mineral licks. Field staff are trained in the identification of wildlife mineral licks. Information on identifying wildlife licks, as well as other wildlife areas, are provided to all field layout staff and contractors.	The sites are spatially stored in Canfor Alberta's Geographic Information System (GIS) and new sites are updated annually. All blocks from the previous harvest season will be spatially compared to Canfor's wildlife mineral lick layer to ensure that no infraction has occurred unless approved in the Final Harvest Plan for some overriding reason	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance unless there is an approved ground rule deviation	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.	
					1.4.1 (b)	Percent of forest management activities consistent with management strategies for sites of biological significance	100% of identified biologically significant sites will have implemented management strategies identified in consultation with the Province	Canfor operations are directed by the Operating Ground Rules and Forest Management Plan. Each of these includes considerations for sites of biological significance.	Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards	All operating plans are reviewed, approved, and monitored by the Province to ensure that the intent of the Operating Ground Rules and the Forest Management Plan are being implemented on the ground.	Operating Plans and approval documents will be reviewed annually to determine the number of additional sites of biological significance.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; all identified special biologically significant sites will have management strategies developed with the Province	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
			1.1.2.3 Maintain aquatic biodiversity by minimizing impacts of water crossings	Forestry water crossings in compliance with Code of Practice for Water Course Crossings within each subunit	3.2.1 (c)	Forestry water crossing construction and maintenance work in compliance with Code of Practice for Water Course Crossings or Operating Ground Rules within each subunit	100% of forestry water crossing construction and maintenance work in compliance with Code of Practice for Water Course Crossings or Operating Ground Rules	The Code of Practice for Watercourse Crossings applies to any crossings with a culvert 1.5 meters and larger in diameter, or bridges with more than a single span. The Operating Ground Rules apply to all smaller crossings not covered by the Code.	Code of Practice for Water Course Crossings, Section 7 to 9 and Schedule 2; Water Act; Timber Management Regulations; Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards	The Annual Operating Plan includes a Road Maintenance, Construction and Abandonment Plan. Included in this plan is a listing of all work to be completed on roads and crossings. The approval of this plan will ensure that all crossings were planned in accordance to the Code or the Operating Ground Rules, whichever apply.	The Annual Operating Plan includes a Road Maintenance, Construction and Abandonment Plan. Annually, in April of each year, the Road Maintenance, Construction and Abandonment Plan will be checked to ensure that all crossings were planned using either the Code, or the Ground Rules, whichever apply.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report, and AOP	No variance; all construction and maintenance work will have the required approvals and will be carried out in compliance with Code of Practice for Water Course Crossings or Operating Ground Rules	If the target is not met a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
					3.2.1 (b)	Drainage structures with identified water quality concerns that have mitigation strategies implemented	100% of medium and high hazard drainage structures will have mitigation strategies implemented according to the road maintenance plan for permanent Canfor Alberta roads	Foothills Stream Crossing Program	Federal Fisheries Act; Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 3.2.1.1	Annual inspections are compiled and entered into the stream crossing database. Those structures with a high or medium risk for adverse impact will be considered for remedial action based on timing of budget development and availability of resources for the following field season.	Number of crossings that received required maintenance as per the number of crossings identified for repairs in the remediation plan	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report, and AOP	90% of medium and high hazard drainage structures will have mitigation strategies implemented according to the road maintenance plan for permanent Canfor Alberta roads	If the target is not met a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.



ESRD Planning Standard Annex 4					Canfor VOITs									
CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Canfor SFMP VOIT #	Indicator	Target	Means to Identify Target	Legal/Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
1.2 Species Diversity Conserve species diversity by ensuring that habitats for the native species found in the DFA are maintained throughout time.	1.2.1 Viable populations of identified plant and animal species	1.2.1.1 Maintain habitat for identified high value species (i.e., economically valuable, socially valuable, species at risk, species of management concern) for the DFA or subunit	Area (ha) of suitable habitat maintained OR Specific population parameter(s) (e.g. trends, distribution, absolute size, recruitment) for the DFA or subunit	Trumpeter swan habitat maintained	1.2.1 (a)		No future winter harvest within 200 meters and no summer harvesting within 800 meters of provincially identified Trumpeter Swan sites	Alberta Wildlife Act and OGRs	Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.2.1.1; Federal Species at Risk Act; Alberta Wildlife Act	At the strategic level, the Trumpeter Swan buffer areas will be withdrawn from the timber harvesting landbase. Canfor staff will check annually in the spring with ESRD Fish and Wildlife for any new or excluded Trumpeter Swan sites in the DFA. At the preliminary design phase, those Trumpeter Swan sites will be identified and a no harvest buffer within 200m of site during winter harvest and 800m during summer harvest will be planned.	Overlay previous season's harvested blocks to Trumpeter Swan buffers in Geographic Information System. Any overlaps will be considered as an infraction, unless approved in the Final Harvest Plan for some overriding reason.	FMP: Maps Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance unless there is an approved ground rule deviation	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
							• No timber harvesting will occur in the Conservation zone identified within the Little Smoky/A La Peche ranges for the period of May 1, 2014-April 30, 2024 • No timber harvesting will occur in the Timber Supply Subunits DS3, DS4 and DS5 within the Little Smoky range for the period May 1, 2014-April 30, 2019 • No timber harvesting will occur in the Timber Supply Subunits DS1, DS2 DS6 and DS7 within the Little Smoky range for the period May 1, 2014-April 30, 2024	The commitment to forego timber harvesting in the Conservation Zone and certain Timber Supply Subunits for an extended period of time assists in the maintenance of existing caribou habitat values and works towards achieving the Federal Recover Strategy Target of reducing habitat disturbance in the range to 65%.	Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 1.2.1.1; Federal Species at Risk Act; Alberta Wildlife Act	No harvesting is sequenced in the Conservation Zone identified within the Little Smoky/A La Peche range for the period May 1, 2014-April 30, 2024; Timber Supply Subunits DS3, DS4 and DS5 within the Little Smoky range for the period May 1, 2014-April 30, 2019; and in the Timber Supply Sub-Units DS1, DS2 DS6 and DS7 within the Little Smoky range for the period May 1, 2014-April 30, 2024.	Overlay all harvested areas with the Caribou Management Zones and verify no harvesting has occurred where harvesting deferrals have been committed to.	Report on amount of harvesting occurred in the conservation and expansion zones by timber supply unit.	None	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
							All future harvested areas, excluding the deciduous broad cover group, in all identified Caribou Management Zones will be reforested to a coniferous standard to reduce alternate prey habitat	Recently harvested blocks create ideal vegetation for alternate prey (moose and deer). As the moose and deer populations increase so does the wolf population which has a direct impact on caribou populations.	The company's silviculturist will monitor all harvested blocks and conduct vegetation management activities where required to reduce alternate prey habitat.	Compare the amount of mixedwood stands harvested within the caribou management area and the amount of area that is planned to be transitioned to pure conifer.	90% of mixedwoods will be transitioned to conifer	Report on status of Canfor's roads south of the Deep Valley Creek	None	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
							Canfor Alberta will have zero contribution to open-route density south of the Deep Valley							



ESRD Planning Standard Annex 4					Canfor VOITs									
CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Canfor SFMP VOIT #	Indicator	Target	Means to Identify Target	Legal/Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
					1.2.2 (b)	Fish risk ranking for bull trout and arctic grayling	100% of watersheds with a high or very high fish risk ranking and >25% Canfor influence will be assessed using Canfor's Fish Risk Flow Chart and have mitigations strategies scheduled and implemented	Fish risk is determined by calculating the road density (km/km^2) utilizing the conceptual approach to fish ranking developed by ESRD.	Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard; Federal Species at Risk Act; Alberta Wildlife Act	Canfor Alberta's current road layer will be updated with new permanent and temporary roads used for the extraction of timber. The road density from this calculation will determine the fish risk ranking based on ESRD's "Conceptual Approach to Fish Risk". Through monitoring fish risk using road densities, forest managers will be able to identify the higher risk watersheds and collaboratively work with government to determine types of mitigation strategies that will reduce the risk to Bull Trout and Arctic Grayling fish populations.	Report annually the fish risk for Bull Trout and Arctic Grayling by watershed through calculating road density (Km/Km^2) of permanent and non-reclaimed temporary forest industry roads within the Main parcel of the Defined Forest Area. The watersheds will be assessed and prioritized using Canfor's Fish Risk Flow Chart. All planned mitigation strategies will be entered into the Foothills Stream Crossing Partnership database and completed activities reported in Canfor's Annual Operating Plan Completed Structure Maintenance Table.	FMP: Maps and Tables of indicator Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	90% of identified very high and high risk watersheds with >25% Canfor influence will have mitigation strategies scheduled and implemented according to plan	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, this will be communicated to Environment and Sustainable Resource Development and course of action will be determined.
						Amount of barred owl habitat available for breeding pairs	The amount of the potential Barred Owl habitat for breeding pairs will not be less than 10% of current levels across the DFA	The Alberta Vegetation Inventory based Barred Owl habitat model was developed to estimate the spatial extent of potential Barred Owl breeding territories on the landscape (Russell, M. 2008). This model will be included in the Spatial Harvest Sequence runs and will be consistent with the planning standard (0, 10, 20, 50, 100 and 200 yrs.).	Alberta Forest Management Planning Standard; Federal Species at Risk Act; Alberta Wildlife Act	The Barred Owl model developed by ESRD will be run concurrently with timber supply scenarios. The outputs of the model will be used to support future management decisions that may influence potential Barred Owl habitat. Operating plans will be consistent with the SHS of the PFMS.	The timber supply model forecasts the area of Barred Owl habitat from the PFMS. Checks will be completed every 5 years to verify trend towards meeting the predicted levels.	FMP: Maps and Tables of indicator Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	The amount of potential Barred Owl Habitat will not be less than 15% of current levels across the DFA	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, this will be communicated to Environment and Sustainable Resource Development and course of action will be determined.
	1.3 Genetic Diversity Conserve genetic diversity by maintaining the variation of genes within species.	1.3.1 Genetic integrity of natural tree populations	1.3.1.1 Retain "wild forest populations" ⁹ for each tree species in each seed zone through establishment of in-situ reserves by the organization or in cooperation with Alberta	Number and area (ha) of in situ genetic conservation areas	1.2.3	Regeneration will be consistent with provincial regulations and standards for seed and vegetative use	100% conformance with the Alberta Forest Genetics Resources Management and Conservation Standards (FGRMS)	Following FGRMS will ensure that seedlings and vegetative material collected and used in reforestation programs meet the genetic requirements of the Province. The FGRMS ensures that there is genetic diversity in those seedlots. FGRMS applies to both forest collected and orchard seed.	Timber Management Regulations; Alberta Forest Genetic Resources Management and Conservation Standards; Alberta Forest Management Planning Standard, Annex 4-Performance Standards	Silviculture staff are required to follow FGRMS.	Data entry into the Alberta Reforestation Information System allows the Province to audit the company's results. Use of the company's database, (Cenega Forest Resources or its successor) provides the tools internally to make reforestation plans that meet the regulations.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; All regeneration will be consistent with the FGRMS	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
			1.3.1.2 Retain wild forest genetic resources through ex-situ conservation	Number of provenances and genetic lines in ex-situ gene banks and trials		Regeneration will be consistent with provincial regulations and standards for seed and vegetative use	100% conformance with the Alberta Forest Genetic Resources Management and Conservation Standards (FGRMS) for all seed collection and seedling deployment	The Alberta FGRMS set the standard for the use of seed and vegetative material that can be used in reforestation programs.	Timber Management Regulations; Alberta Forest Genetic Resources Management and Conservation Standards; Alberta Forest Management Planning Standard, Annex 4-Performance Standards	Silviculture staff are required to follow FGRMS.	Data entry into the Alberta Reforestation Information System allows the Province to audit the company's results. Use of the company's database, (Cenega Solutions Inc. or its successor) provides the tools internally to make reforestation plans that meet the regulations. Information provided to the contractor will identify correct deployment of seedlings	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; All regeneration will be consistent with the FGRMS	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.



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	1.4 Protected Areas - Respect protected areas identified through government processes	1.4.1 Areas with minimal human disturbances within managed landscapes	1.4.1.1 Integrate transboundary values and objectives into forest management	Stakeholder consultation	1.4.1(a)	Percent of forest management activities where consultation has occurred for operations near protected park areas	The Province will be consulted 100% of the time when operations will occur within one kilometer of legally protected park areas	Link to consultation objective in Planning Standard and CSA Z809-08 indicator 1.4.1	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards	When harvesting operations are planned to occur near legally protected areas such as the Dunvegan West Wildland Park, the government department responsible for that area will be consulted.	Evidence that consultation has occurred for operations within 1km of protected park boundaries will be recorded in Canfor's Creating Opportunities for Public Involvement database.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; All planned harvest within one kilometer of a Protected Park Area will have consultation records	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
						Percent of identified historic, sacred and culturally important sites, forest values, traditional knowledge and uses known or identified through communication are considered in forestry planning processes	100% of historic, sacred and culturally important sites, forest values, traditional knowledge and uses known or identified through communication are considered in forestry planning processes	Linked to consultation objective in Planning Standard and Alberta's expectations in <i>Government of Alberta Proponent Guide to First Nations Consultation Procedures for Land Dispositions (February, 2015)</i>	Alberta's First Nation's Consultation Guidelines on Land and Natural Resource Management (July 2014); Government of Alberta Proponent Guide to First Nations Consultation Procedures for Land Dispositions (February, 2015); Alberta Historical Resources Act; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.1.1.1	Canfor Alberta uses a database called Creating Opportunities for Public Involvement (COPI) to keep record of all attempts to consult, items discussed, actions, and follow-up. The details that are entered into COPI will be in accordance with Alberta's Procedural Steps for Consultation with Aboriginal Groups. Historic sites are identified, evaluated, and managed through the archaeological process.	All records of consultation will be entered into COPI. Archeological assessments are tracked for all blocks in Canfor's Cenega Database. Status reports can be created from this database as a method of monitoring.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; all identified sites will be considered	If the targets are not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
2.) Ecosystem Productivity	2.1 Ecosystem resilience	2.1.1 Reforested harvest areas	2.1.1.1 Meet reforestation targets on all harvested areas	Annual % of SR regeneration surveys	2.1.1 (a)	Prompt reforestation	100% of all harvested blocks will be reforested within 2 years	ARIS Reports	Timber Management Regulation; Canfor Forest Management Agreement area Operating Ground Rules	All harvested blocks will have reforestation strategies/activities scheduled for completion no more than 2 years after harvest.	A database query of the reforestation activities completed by April 30th of the following year will be compared to the harvesting report. Any blocks that do not meet the 2-year reforestation requirement will be reported as an infraction in Canfor's Incident Tracking System.	Performance: ARIS, AOP, Stewardship Report, Canfor Annual Performance Monitoring Report	No variance; 100% of all harvested blocks will be reforested within 2 years. Planting of top piles and roads are not considered in this target as they may be completed later than two years to accommodate the burning of top piles	If the targets are not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
						Prompt reforestation of failed areas	All harvested blocks that have not achieved the regeneration targets as per the initial treatment, as defined in the Regeneration Standards of Alberta (RSA). Alberta establishment survey standards will have remedial treatments completed within 12 months of the survey date	Prompt retreatment of areas not successfully reforested on the initial treatment, as defined in the Regeneration Standards of Alberta (RSA).	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 2.1.1.1; Timber Management Regulations; Regeneration Standards of Alberta	When establishment surveys are completed, a list of blocks requiring remedial treatment is generated. Remedial treatments will be planned and completed within 12 months of the survey dates.	Any blocks that did not receive remedial treatment within 12 months of the regeneration survey date will be entered into Canfor's Incident Tracking System as an infraction.	Performance: ARIS, Stewardship Report, Canfor Annual Performance Monitoring Report	A six-month variance to the twelve-month retreatment period will apply for up to 50% of the blocks requiring remediation treatments. The six months allows for surveys done in the spring of one year to have treatments done in the following summer when seedlings may not be available the first summer	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
					2.1.1 (c)	Cumulative % of reforested areas that meet reforestation target	Actual regenerated stand yield compared to the yield expectations of the Timber Supply Analysis	The regenerated stand yield (Mean Annual Increment) for the total of all sampling populations will meet or exceed the regenerated stand yield assumptions of the Timber Supply Analysis in the Regeneration Standards of Alberta performance survey process	Regeneration Standards of Alberta provides the tools to measure and report the growth predictions of reforested stands in comparison to the yield expectations of the Timber Supply Analysis.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 5.2.3.1; Timber Management Regulation; Regeneration Standards of Alberta	Prompt and effective reforestation programs will create regenerating stands. Upon completion of initial reforestation treatments, there are additional programs to monitor regeneration success prior to conducting a Regeneration Standards of Alberta performance survey. The Regeneration Standards of Alberta process provides the tools to measure and compare yields.	All Regeneration Standards of Alberta program results will be reviewed and compared to Forest Management Plan mean annual increment targets. The Regeneration Standards of Alberta results are accumulated and incorporated into future forest management plan Timber Supply Analysis.	Performance: ARIS, Stewardship Report, Canfor Annual Performance Monitoring Report	The 5 year average must meet the mean annual increment targets for the current quadrant period

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3. Soil and water	3.1 Soil quantity and quality	2.1.2 Maintenance of forest landbase	2.1.2.1 Limit conversion of productive forest landbase to other uses	Amount of change in forest landbase	2.2.1/4.2	Percent of gross forested land base in the DFA converted to non-forest land use through forest management activities	Forest management company activities not to exceed 3% reduction in gross Defined Forest Area over the life of the Forest Management Agreement (May 26, 1964)	Forest inventory and landuse data	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 2.1.2.1 and 4.2	Maintain current forest cover inventory and land use updates. Work with other industrial users to coordinate plans and promote the practice of Integrated Land Management.	Conversion to non-forest landuse includes construction of roads, gravel pits, camp clearings etc. All new dispositions will be quantified on the forest landbase annually.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Forest management company activities will not exceed 3% reduction in gross area Defined Forest Area over the life of the Forest Management Agreement (May 26, 1964)	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
		2.1.2.2 Recognize lands affected by insects, disease or natural calamities	Amount of area affected	None	Presence or absence, or area affected by significant outbreaks, infestations, and natural calamities	Report on presence or absence, or area affected by significant outbreaks, infestations, natural calamities	To maintain healthy forests it is important to monitor and track insect and disease outbreaks as well as other natural calamities that can affect the forest ecosystem productivity	Alberta Forest Management Planning Standard, Annex 4 - Performance standards 2.1.2.2	Forest health surveys, inventory updates, ESRD surveys, Canfor staff and contractor identification and reporting	Annually obtain records from ESRD and report any findings to ESRD	Performance: Stewardship Report, and Canfor Annual Performance Monitoring Report	None	Adjust activities	
		2.1.3 Control invasive species	2.1.3.1 Control non-native plant species (weeds)	Noxious weed program	Noxious weed program implementation	100% of noxious weeds identified along Canfor Alberta's dispositions will have treatments scheduled and completed according to the plan	ESRD Directive No. 2001-06 Weed Management in Forestry Operations	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 2.1.3.1; Weed Control Act part 1, ESRD Directive 2001-6	Canfor staff are required to complete noxious weed training in which reporting procedures are outlined. Canfor staff and the municipal weed inspectors collect locations and species of weeds identified on the Defined Forest Area. Data is entered into the Cengea Solutions Inc. database and is compiled in the Road Maintenance Plan when along surface dispositions and as a "Noxious Weeds" activity in Cengea when identified in timber dispositions.	Treatments of identified noxious weeds scheduled in the Road Maintenance Plan or Cengea "Noxious Weeds" activity	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	90% of identified weeds must be treated	Adjust activities	
3. Soil and water	3.1 Soil quantity and quality	3.1.1 Soil productivity	3.1.1.1 Minimize impact of roading and bared areas in forest operations	Compliance with OGRs	3.1.1 (a)	Percent of harvested blocks meeting soil disturbance objectives identified in plans and Operating Ground Rules	100% of harvested blocks will not exceed 5% soil disturbance without government approval as outlined in Canfor Operating Ground Rules	The Operating Ground Rules 9.0.3 state that the area disturbed by roads cannot exceed 5% of the block area without specific approval	Canfor Operating Ground Rules; Timber Management Regulations; 1994 Forest Soils Conservation Guidelines (or its successors)	The Final Harvest Plan lists the blocks to be harvested, and the percentage of area to be occupied by roads planned for each individual block.	The percent of road area is calculated and reported annually to the Province. After harvesting is completed, area of as built roads will be recalculated and compared to the approved blocks that exceeded the 5% disturbance.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; 100% of harvested blocks will not exceed 5% soil disturbance without government approval as outlined in Canfor Operating Ground Rules	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified
			3.1.1.2 Minimize incidence of soil erosion and slumping	Incidence of soil erosion and slumping	3.1.1 (b)	Percent of soil erosion and slumping incidences with mitigation strategies implemented	100% of known significant erosion and slumping events caused by forest operations will have mitigation strategies implemented within one year of identification	Erosion and slumping can reduce the productivity of the forest soils. Operational practices that promote soil stability and minimize soil movement will be implemented	Canfor Forest Management Agreement area Operating Ground Rules; Timber Management Regulation; Soil Guidelines; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 3.1.1.2	All significant in block slumps greater than 1000 m ² and erosion events on roads where the erosion is greater than 20 cm deep by 3 meters, caused by forest industry activities, will be documented with root cause investigations.	Ensure that identified soil erosion and slumping events have a mitigation strategy entered into Canfor's Incident Tracking System and those scheduled strategies are completed in accordance to the plan.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; All reportable incidents will have mitigation strategies implemented within one year of identification	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
	3.2 Water quantity and quality	3.2.1 Water quantity	3.2.1.1 Limit impact of timber harvesting on water yield	Forecast impact of timber harvesting on water yield.	3.2.1 (a)	Watersheds with high risk level assessments with mitigation strategies implemented	100% of watersheds with a moderate or high risk levels will have approved mitigation strategies implemented	ESRD Watershed Hazard Assessment projects changes to the flow regime (frequency, timing and magnitude of peaks and low flows) from the planned harvesting.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 3.2.1.1; Water Act	ESRD's Watershed Hazard Assessment will be used for the 2015 FMP. Watersheds projected to reach high or moderate risk levels based on the 10 year SHS will have mitigation strategies implemented, in consultation with ESRD.	Determine the watershed risk rankings. Report on which of those watersheds has mitigation strategies implemented.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; All high and moderate risk ranked watersheds based on the 10 year SHS with scheduled operations will have mitigation strategies implemented, in consultation with ESRD	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.



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	3.2.2 Effective riparian habitats	3.2.2.1 Minimize impact of operations in riparian areas	Riparian buffers maintained as outlined in OGRs	1.1.4 (c)	Number of non-compliances where forest operations are not consistent with riparian management requirements as identified in operation plans (same metric as 1.1.1.6)	Zero non-compliances, specific to Operating Ground Rules, with riparian areas reported to the Province, or found by the Province will be reported.	Operating Ground Rules infractions involving riparian areas reported to the Province, or found by the Province will be reported.	Timber Management Regulations; Canfor Forest Management Agreement area Operating Ground Rules; Federal Fisheries Act; Water Act; and Alberta Forest Management Planning Standard, Annex 4 – Performance Standards	Block and road layout prior to harvest requires the identification of all riparian areas (as per Operating Ground Rules). Operating and road maintenance plans will include operational strategies for riparian areas.	Self-reporting, Internal/External audits, final harvest inspections, and Forest Operations Monitoring Program.	Performance: AOP, Stewardship Report, and Canfor Annual Performance Monitoring Report	Zero non-compliances, specific to Operating Ground Rules, with riparian management requirements in forest operations	Remediation of any outstanding issues is the first priority. All incidents are investigated. Root cause analysis is conducted where the cause is not clear. Strategies and procedures will be modified where appropriate.	
4. Global Ecological Cycles	4.1 Carbon uptake and storage	To be determined	To be determined	Results of carbon budget modeling	4.1.1	The tonnes of carbon stored in each of the carbon pools	Achieve 100% of the carbon stored in each of the carbon pools as defined by the Preferred Forest Management Scenario forecast	CFS-CBM-3 model developed by the Canadian Forest Service	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 4.1	The CFS-CBM-3 model developed by the Canadian Forest Service has been used to forecast the amount of carbon stored in each carbon pool under the Preferred Forest Management Scenario. Following this harvest forecast will result in achieving these target values on the ground.	Future forest modelling will include this indicator and changes to management assumptions will be assessed based on their impacts to carbon sequestration.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	+/-20% of the Preferred Forest Management Scenario for the 10 year forecast values	If the target is not met a root cause analysis will be completed to determine cause. Once cause is determined the process may be modified.
	4.2 Forest land conversion	See 2.1.2 above			2.2.1/4.2	Percent of gross forested land base in the DFA converted to non-forest land use through forest management activities	Forest management company activities not to exceed 3% reduction in gross Defined Forest Area over the life of the Forest Management Agreement (May 26, 1964)	Forest inventory and landuse data	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 2.1.2.1 and 4.2	Maintain current forest cover inventory and land use updates. Work with other industrial users to coordinate plans and promote the practice of Integrated Land Management.	Conversion to non-forest landuse includes construction of roads, gravel pits, camp clearings etc. All new dispositions will be quantified on the forest landbase annually.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Forest management company activities will not exceed 3% reduction in gross area Defined Forest Area over the life of the Forest Management Agreement (May 26, 1964)	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
5. Multiple Benefits to Society	5.1 Timber and non-timber benefits	5.1.1 Sustainable timber supplies	5.1.1.1 Establish appropriate AACs	Process described in Annex 1 is followed and standards are met	2.2.2/5.1 .1 (a)	Percent of volume harvested compared to long term harvest level	Not to exceed 100% of the approved harvest level (Annual Allowable Cut) over 5 years (5 yr. quadrant balance)	The Timber Supply Analysis is developed as per the legal requirements of the Forest Management Agreement (Alberta. 2015).	Alberta Forest Management Planning Standard; Forest Act; Timber Management Regulation; Forest Management Agreement	The reconciliation is a comparison of the actual versus allowed harvest levels. The target ensures that the company does not over-harvest.	Actual annual harvested volume is obtained from the Timber Product Revenue System (TPRS) audit completed by ESRD and is reported in the General Development Plan and the Annual Performance Monitoring Report. Evaluation of performance to this target will be done when TPRS audited quadrant volumes are available.	Performance: AOP/GDP, Stewardship Report and Canfor Annual Performance Monitoring Report	The actual quadrant harvest volume will not exceed 5% of the allowable harvest level.	Adjust activities
	5.2 Communities and Sustainability	5.2.1 Risk to communities and landscape values from wildfire is low.	5.2.1.1 To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing fire suppression capability	1) Percentage reduction in Fire Behaviour Potential area (ha) within the FireSmart Community Zone	None	Percentage reduction in Fire Behaviour Potential area (ha) within the FireSmart Community Zone	Reduce the area (ha) in the extreme and high Fire Behaviour Potential rating categories by 0.8% within the combined FireSmart Community Zones over a 10 year period	ESRD has completed a landscape fire assessment on the DFA to identify the current status in regards to Fire Potential Behaviour. Canfor is able to reduce the Fire Potential Behaviour in adjacent Fire Community Zones and the DFA by harvesting stands assessed as extreme and high Fire Behaviour Potential.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 5.2.2.1	Through implementing the approved SHS, Canfor should achieve the targeted reduction in Fire Behaviour Potential of the FireSmart Community Zones and the DFA over a 10 year period.	Cutblocks harvested will be overlaid with the Fire Behavior Potential shapefile to identify % reduction in high and extreme Fire Behaviour Potential stands.	Performance: Stewardship Report	Reduction of Fire Behaviour Potential of the Fire Community Zones and the DFA must be within 0.5% of the target	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
				2) Percentage reduction in Fire Behaviour Potential area (ha) across the DFA now and over the planning horizon		Percentage reduction in Fire Behaviour Potential area (ha) across the DFA now and over the planning horizon	Reduce the area (ha) in the extreme and high Fire Behaviour Potential rating categories by 2% across the DFA over a 10 year period							



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		5.2.2 Provide opportunities to derive benefits and participate in use and management	5.2.2.1 Integrate other uses and timber management activities	Extent of various uses	5.1.1 (b)	Maintenance of recreational areas for non-timber values	Canfor Alberta will maintain a minimum of 3 recreational areas for use by the public within Defined Forest Area	Recreational use of the DFA is a common non-timber value. The company will continue to maintain recreational areas for public use in at least three sites.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 5.2.2.1	The company will fund, or seek funding to maintain contractual agreements for recreational areas, such as MacLeod Flats, Economy Lake, Westview and Frying Pan Creek.	Documentation showing contractual agreements for recreational areas maintenance will indicate which recreational areas supported.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Canfor Alberta will maintain a minimum of 3 recreational areas for use by the public within Defined Forest Area.	Adjust activities
						Investment in local communities	Over a rolling 5-year period, a minimum of 75% of Canfor Alberta forest operations dollars paid for contract services will be expended locally	Forests represent not only a return on investment (measured, for example, in dollar value, person-days, donations, etc.) for the organization but also a source of income and non-financial benefits for Defined Forest Area-related workers, contractors, and others; stability and opportunities for communities; and revenue for local, provincial, and federal governments.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 5.2.2.1	Opportunities will be provided to local contractors.	The total dollar value of contract services considered to be local will be calculated relative to the total dollar value of all contract services provided.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Over a rolling 5-year period, a minimum of 75% of Canfor Alberta forest operations dollars paid for contract services will be expended locally	Adjust activities
						Investment in local communities	Canfor Alberta will provide financial/in-kind support to a minimum of 8 community events or services	Level of investment in initiatives that contribute to community sustainability	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 5.2.2.1	Canfor Alberta has maintained a strong community presence since 1964 and will continue to provide financial/in-kind support in the local community.	Report annually the number of community events or services Canfor has provided financial/in-kind support.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Canfor will provide financial/in-kind support to a minimum of 8 community events or services	Adjust activities
		5.2.3 Forest Productivity	5.2.3.1 Maintain Long Run Sustained Yield Average	Regenerated stand yield compared to natural stand yield	2.2.2/5.1 .1 (a)	Percent of volume harvested compared to long term harvest level	Not to exceed 100% of the approved harvest level (Annual Allowable Cut) over 5 years (5 yr. quadrant balance)	The Timber Supply Analysis is developed as per the legal requirements of the Forest Management Agreement (Alberta. 2015).	Alberta Forest Management Planning Standard; Forest Act; Timber Management Regulation; Forest Management Agreement	he reconciliation is a comparison of the actual versus allowed harvest levels. The target ensures that the company does not over-harvest.	Actual annual harvested volume is obtained from the Timber Product Revenue System (TPRS) audit completed by ESRD and is reported in the General Development Plan and the Annual Performance Monitoring Report. Evaluation of performance to this target will be done when TPRS audited quadrant volumes are available.	Performance: AOP/GDP, Stewardship Report and Canfor Annual Performance Monitoring Report	The actual quadrant harvest volume will not exceed 5% of the allowable harvest level	Adjust activities
6. Accepting society's responsibility for sustainable development	6.1 Aboriginal and treaty rights and aboriginal forest values	6.1.1 Compliance with government regulations and policies	6.1.1.1 Implement Public Involvement Program	Meet Alberta's current expectations for aboriginal consultation	6.1.2	Members of local Aboriginal communities will be provided ample opportunity to understand Canfor Alberta's Forest Management Plan	Opportunity to communicate key components of the Forest Management Plan have been provided to each affected local Aboriginal group	<i>Alberta's Aboriginal Groups Consultation Guidelines on Land Management and Resource Development (November 2007)</i> state that FMPs must be communicated with Aboriginal Groups identified on as having interest in the FMA area	Alberta's Aboriginal Groups Consultation Guidelines on Land Management and Resource Development (November 14, 2007); Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.1.1.1; SRD Lands and Forestry First Nations Consultation Operating Procedures (May, 2011)	A description of Canfor Alberta's intent to ensure successful communication of the Forest Management Plan to Aboriginal groups is outlined in Canfor's Terms of Reference 2012 Forest Management Plan for Canfor Forest Management Agreement area 9900037 as well as Canfor's Aboriginal Consultation Plan.	All communication as it relates to the Forest Management Plan will be recorded in Canfor's COPI database.	Performance: Records of Consultation, Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Opportunity to communicate key components of the forest management plan have been provided to each affected local Aboriginal group	Adjust activities



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CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Canfor SFMP VOIT #	Indicator	Target	Means to Identify Target	Legal/Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
					6.1.3	Percent of forest operations in conformance with operational/ site plans developed to address Aboriginal forest values, traditional knowledge and uses	100% of forest operations are conducted in conformance with operational/site plans that have been developed to address Aboriginal forest values, traditional knowledge and uses	Conformance to applicable policies and reporting/monitoring procedures ensures that identified Aboriginal forest values, traditional knowledge, and uses are addressed as intended.	Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.1.1.1; Alberta's First Nation's Consultation Guidelines on Land and Natural Resource Management (July 2014)	In order to ensure conformance with operational/site plans, Canfor Alberta operations supervisors are required to conduct regular site inspections. In addition to these inspections, operations are audited by internal and external parties on an annual basis.	All communication and actions as it relates to operational/site plans will be recorded in Canfor's COPI database.	Performance: Records of Consultation, Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; All operational/site plans that have been developed to address Aboriginal forest values, traditional knowledge and uses will be implemented	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
					6.2.1	Percent of identified historic, sacred and culturally important sites, forest values, traditional knowledge and uses considered in the planning process	100% of historic, sacred and culturally important sites, forest values, traditional knowledge and uses known or identified through communication are considered in forestry planning processes	Link to consultation objective in Planning Standard and Alberta's expectations in <i>Government of Alberta Proponent Guide to First Nations Consultation Procedures for Land Dispositions (February, 2015)</i>	Alberta's First Nation's Consultation Guidelines on Land and Natural Resource Management (July 2014); Government of Alberta Proponent Guide to First Nations Consultation Procedures for Land Dispositions (February, 2015); Alberta Historical Resources Act; Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.1.1.1	Canfor Alberta uses a database called COPI to keep record of all attempts to consult, items discussed, actions, and follow-up. The details that are entered into COPI will be in accordance with Proponent Guide to First nations Consultation Procedures for Land Dispositions with Aboriginal Groups. Historic sites are identified, evaluated, and managed through the archaeological process.	All records of consultation will be entered into COPI. Archeological assessments are tracked for all blocks in Canfor's Cengea Database. Status reports can be created from this database as a method of monitoring.	Performance: Records of Consultation, Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; All identified sites will be considered	If the targets are not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
	6.2 Public participation and information for decision-making	6.2.1 Meaningful public involvement is achieved	6.2.1.1 Implement public involvement program	Meet expectations of Section 5 of CSA Z809-02	6.4.1	Public advisory group maintained and satisfaction survey implemented	80% annual satisfaction from surveys in all four targets	Maintain Canfor Alberta's Forest Management Advisory Committee (FMAC) and implement the FMAC Evaluation Form.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.2.1.1	Canfor Alberta will provide all FMAC members a FMAC Evaluation Form to measure the effectiveness and awareness with the process.	FMAC members will fill out the FMAC evaluation Form after each meeting. Each of the four sections of the survey will be calculated and results will be compiled for each calendar year.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	A minimum of 70% annual satisfaction from surveys from all four targets	If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.
					6.4.2	Number of educational opportunities for information/ training/ capacity building that are delivered to the public advisory group annually	Provide one educational opportunity per Forest Management Advisory Committee meeting , plus one field tour opportunity per year	This indicator and target recognizes the importance of providing informational or training opportunities for members of the FMAC, which in turn contributes to a more knowledgeable and effective committee.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.2.1.1	Canfor Alberta will provide informational/educational/capacity building opportunities for FMAC members at each regularly held meeting. In addition, Canfor Alberta will offer one field tour annually	Report in the Annual Performance Monitoring Report the number of educational opportunities and field tours presented to the FMAC as recorded in the FMAC meeting minutes.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Opportunities will be provided	Adjust activities
					6.5.1	The number of educational opportunities provided to the community	A minimum of 5 educational opportunities provided to the community annually	Informed and engaged, members of the public can provide local knowledge and support that contributes to socially and environmentally responsible forest management.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.2.1.1	Canfor Alberta will provide educational opportunities to the community annually	Number of educational opportunities provided.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; At least five opportunities will be provided annually	Adjust activities
					6.4.3	Number of opportunities for information/ training/ capacity development that are delivered to the Aboriginal communities annually	Greater than or equal to 1 Aboriginal information/training/capacity development opportunity per year	Open, respectful communication with local Aboriginal communities includes not only the company understanding the Aboriginal rights and interests but for the Aboriginals to understand the company's forest management plans and processes.	Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 6.2.1.1	Canfor Alberta will offer a minimum of one information/training/capacity development opportunity per year to the Aboriginal communities.	All opportunities offered as it relates to information/training/capacity development will be recorded in Canfor's Creating Opportunities for Public Involvement database.	Performance: Stewardship Report and Canfor Annual Performance Monitoring Report	No variance; Greater than or equal to 1 Aboriginal information/training/capacity development opportunity per year	Adjust activities

9.1.1 ANNEX 4

9.1.1.1 (Annex 4 Objective 1.1.1.3b) Road Density

Criterion 1: Biological Diversity	Element 1.1 Ecosystem Diversity
Value	Landscape scale biodiversity
Objective	Maintain biodiversity by minimizing access
CSA Core Indicator	n/a AESRD VOIT 1.1.1.3b)
Indicator Statement	Open seasonal / temporary forestry road length by DFA
Description of indicator	One way to gauge the biodiversity of an area is to measure the amount of roads per unit area. Road density is an indication of the influence of human activity on an area and the state of its wildlife populations, streams and natural processes.
Target	Density of open seasonal/ temporary forestry roads (lineal km/km²) not to exceed 0.15km/km² across the Defined Forest Area
Description of target	Density of roads (Open Seasonal/Temporary Forestry roads) is a measure of industrial footprint.

Basis for the Target

The basis for the target is to minimize the footprint as it relates to open seasonal/temporary forestry roads. Minimizing the industrial footprint on the landscape through strategic road planning and prompt reclamation will maintain biodiversity by reducing access to areas from the public, habitat fragmentation, and impacts to water quality and quantity.

Means of Achieving Objective & Target (Strategies)

Strategic designing of open seasonal/ temporary forestry roads during the planning stage will help reduce the amount of open/temporary forestry roads that are needed in forestry operations. All open seasonal/temporary forestry roads are identified and submitted to AESRD as part of Forest Harvest Plans. At the end of the harvest season the “as-built” roads are verified and upon completion of reclamation activities, will receive final clearance from AESRD. Canfor aims to achieve final clearance of open seasonal/temporary forestry roads that are no longer needed as per Operating Ground Rule 11.2.4 in order to reduce access and industrial footprint across the DFA.

Current Status

Of the 1047.8km of open seasonal/temporary roads built since 2010, there is currently 791.9km pending Final Clearance (Table 54). The current open seasonal/temporary forestry road density is 0.12km/km² on the FMA area Table 55.

Table 54 Open Seasonal/Temporary Roads History

Year	Final Clearance Pending (km)	Final Clearance Completed (km)	Total (km)
2010	6.3	216.7	223.1
2011	186.2	23.6	209.8
2012	259.2	15.6	274.7
2013	147.5		147.5
2014	192.7		192.7
Total	791.9	255.9	1047.8

Table 55 Current Open Seasonal/Temporary Forestry Road Density

FMA (km ²)	Open Seasonal/Temporary Roads (km)	Open Seasonal/Temporary Forestry Road Density km/km ²
6447	791.9	0.12

Forecast

Minimizing road density of open seasonal/temporary forestry roads will reduce the anthropogenic footprint on the landscape, which will assist in maintaining biodiversity across the DFA.

Legal Requirements

Canfor Forest Management Agreement area Operating Ground Rules; Alberta Forest Management Planning Standard-Annex 4

Monitoring & Measurement

Annual:

Canfor's road data layer will be updated annually for all as-built temporary forestry roads and label which roads are reclaimed, open, or final cleared. Calculate the road density of the open seasonal/temporary forestry roads that have not received final clearance.

Reporting Process

Open seasonal/temporary forestry road density will be tracked in the Annual Operating Plan and reported in the 5 Year Stewardship Report.

Acceptable Variance

Open seasonal/temporary forestry road density will not exceed 0.2km/km² across the DFA.

Response

If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, this will be communicated to AESRD and a course of action will be determined.

9.1.1.2 (Annex 4 Objective 2.1.2.2) Natural Calamities

Criterion 2: Ecosystem Condition and Productivity	Element 2.2: Forest Ecosystem Productivity
Value	Maintenance of forest landbase
Objective	Recognize lands affected by insect, disease or natural calamities
CSA Core Indicator	n/a AESRD VOIT 2.1.2.2
Indicator Statement	Presence or absence, or area affected by significant outbreaks, infestations, and natural calamities
Description of indicator	To maintain healthy forests it is important to monitor and track insect and disease outbreaks as well as other natural calamities that can affect the forest ecosystem productivity
Target	Report on presence or absence, or area affected by significant outbreaks, infestations, natural calamities
Description of target	Alberta Environment and Sustainable Resource Development maintain current up-to-date information. It is important to know progression and to assist in the monitoring of such outbreaks and other natural calamities.

Basis for the Target

Forest health can be influenced by many different factors including insect, disease, and natural calamities which include weather events such as flooding, hail, and strong winds. Canfor continually monitors forest health for any significant outbreaks or events that might impact the forest landscape.

There have been very few fires on the Forest Management Area in the past fifty years. The largest fire of 450ha occurred in 2006 south of the Deep Valley Creek.

In the last 40 years there have been three major flood events, with the most recent occurring in 2011. These events have changed river channels and taken out bridges and culverts.

Extreme winds are not uncommon in this area. These winds can have a detrimental impact on standing trees. Planning wind firm harvest boundaries is a challenge and areas of extreme blowdown are reported when observed and are dealt with as per target 1.1.4e) Balancing Fibre and Ecological Factors in Blowdown Forest Areas.

In the mid-90s a major tornado hit the FMA area. It started in Twp 64 Rge 24 W5M and travelled the Simonette River towards the Latornell River and west of Sturgeon Lake along Hwy 43. The tornado touched down in several places and resulted in small patches of trees being broken and blown down.

There have been two significant hail events on the FMA in the last several years; one in the Bolton Creek area (Twp 59 Rge 4 W6M) where merchantable trees appeared to be damaged and the 2nd in Twp 61 Rge 26 W5M up to Twp 66 Rge 24 W5M, where the younger reforested blocks appeared to be damaged. Both events were monitored and both areas recovered.

Currently, the biggest impact and threat to forest ecosystem productivity on Canfor's FMA area is Mountain Pine Beetle infestation (MPB). The inflight of Mountain Pine Beetle from British Columbia that occurred in 2006 and again in 2009 greatly impacted the Grande Prairie and Peace Region forests. AESRD has an active MPB monitoring, survey, and treatment program in place to address MPB in the region. Canfor also monitors the FMA area annually for MPB progression and has modified harvest plans to harvest infected stands based on the monitoring results and recommendations from AESRD based on their monitoring and survey programs.

AESRD developed a MPB strategy in December of 2007. In this strategy, three MPB management priority zones have been defined: Leading Edge, Active Holding and Inactive zones. These zones may be updated annually depending on survey results.

The Leading Edge zone has the highest priority as it is where MPB populations threaten to spread along the eastern slopes and eastward into the Boreal forest. Surveys are conducted yearly and where there are active MPB trees found, AESRD will schedule these to be spot treated (level 1); infested trees are removed generally by cut and burn during the winter's months. Prior to the winter's program the forest companies are consulted to determine where scheduled level 1 efforts may overlap harvest plans in order to coordinate operations.

The Active Holding zone has a higher infestation rate across the landscape and generally contains larger patches of infested trees than the Leading Edge zone. The objective for this zone is to ensure beetle populations remain static. AESRD will consult the forest companies to review the next two year's harvest plans. Harvesting infested areas by forest companies is commonly referred to as level 2 treatment where the forest company harvests and utilizes the pine. AESRD may recommend that the forest companies alter their plan and/or supplement with level 1 treatment where there are no harvest plans at that time.

The Inactive Holding Zone is a salvage zone where more than 50% of the pine is attacked or dead. The main objective is to minimize the merchantable volume that might be lost due to degrading log quality and to help reduce the fire hazard of dead and dying trees.

Means of Achieving Objective & Target (Strategies)

Forest health surveys, inventory updates, AESRD surveys, Canfor staff and contractor identification and reporting.

Current Status

In 2006, the FMA was within the Leading Edge zone. Since then, the leading Edge zone has progressed south and east as shown in Figure 118 and Figure 119.

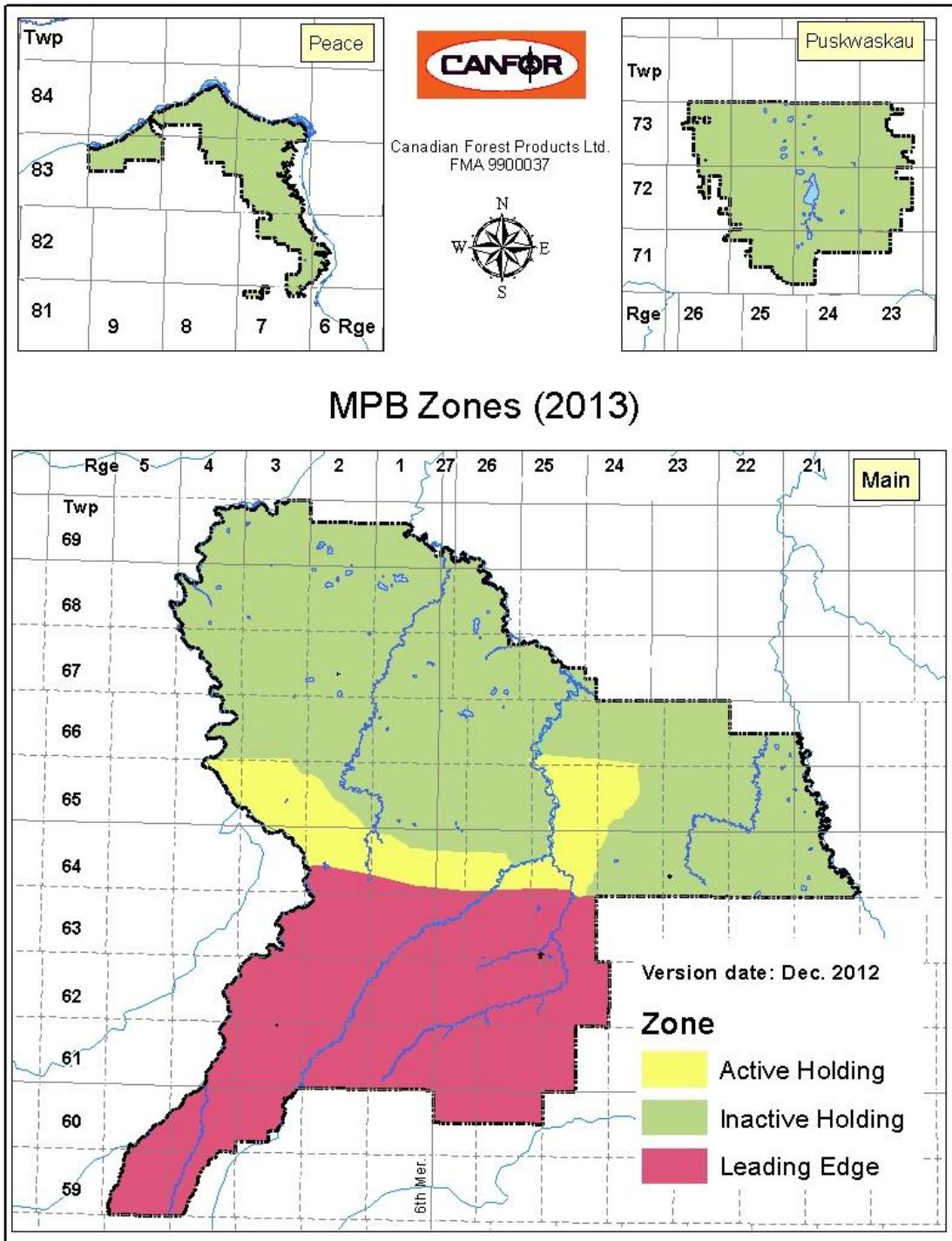


Figure 118 2013 Canfor FMA Area MPB Zones

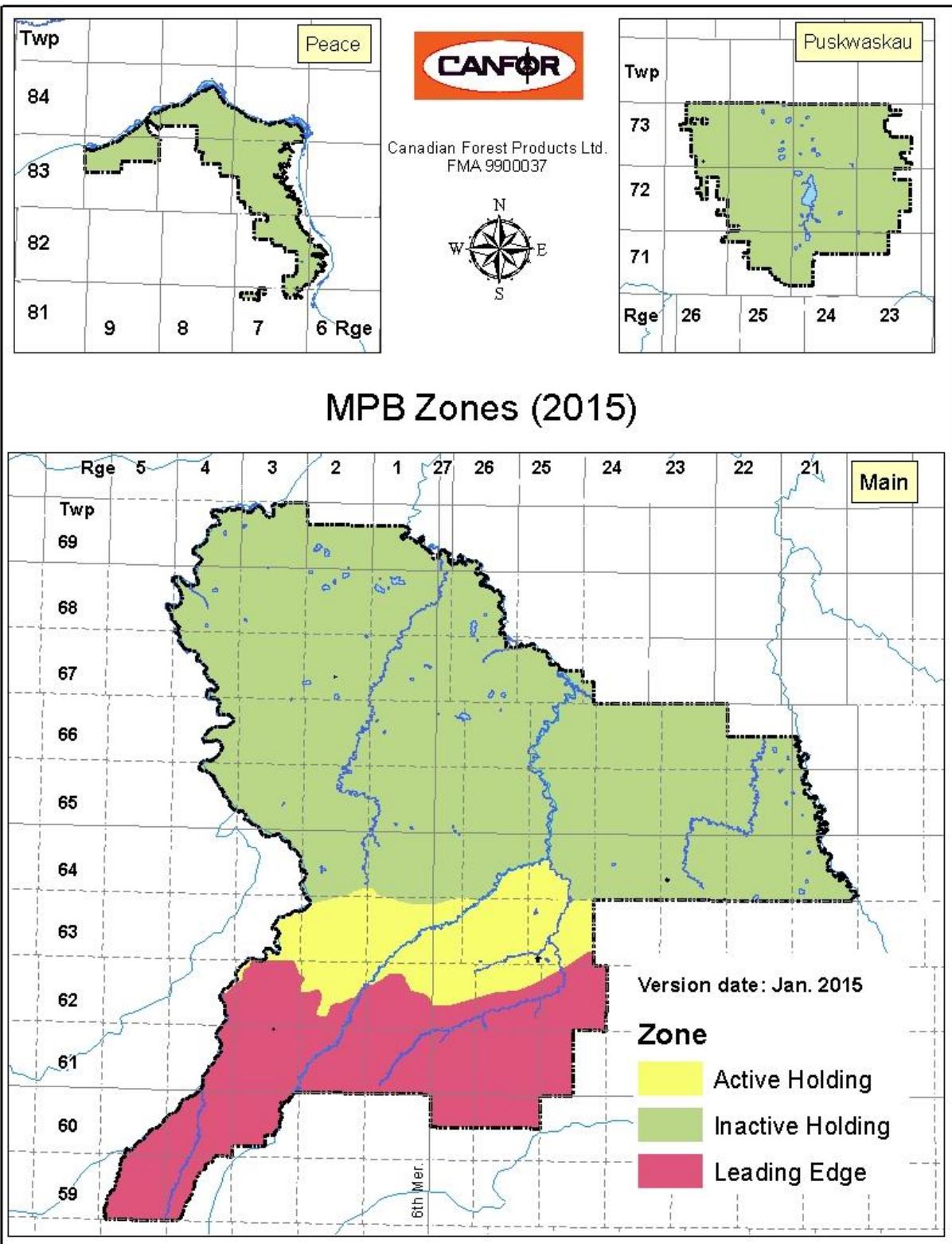


Figure 119 2015 Canfor FMA MPB Zones



Forecast

By following the “Means of Achieving Objective and Target (Strategies)” sections of this indicator, forest ecosystem productivity will be maintained.

Legal Requirements

Alberta Forest Management Planning Standard, Annex 4, Annual Operating Plan, five-year Stewardship Report

Monitoring & Measurement

Annual:

Obtain records from AESRD and report any findings to AESRD

Reporting Process

AOP and 5 year Stewardship Report

Acceptable Variance

None

Response

Adjust activities

9.1.1.3 (Annex 4 Objective 5.2.1.1) Fire Behaviour

Criterion 1: Multiple Benefits to Society	Element 5.2 Communities and Sustainability
Value	Risk to communities and landscape values from wildfire is low
Objective	To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk, and enhancing fire suppression capability
CSA Core Indicator	n/a AESRD VOIT 5.2.1.1
Indicator Statement	<p>1) Percentage reduction in Fire Behaviour Potential area (ha) within the FireSmart Community Zone</p> <p>2) Percentage reduction in Fire Behaviour Potential area (ha) across the DFA now and over the planning horizon</p>
Description of indicator	Fires have the potential to significantly impact communities located directly adjacent to forested Crown Land. In order to minimize the risk of wildfire occurring and impacting local communities, it is essential to lower the Fire Behaviour Potential of the DFA.
Target	<p>1) Reduce the area (ha) in the extreme and high Fire Behaviour Potential rating categories by 0.8% within the combined FireSmart Community Zones over a 10-year period.</p> <p>2) Reduce the area (ha) in the extreme and high Fire Behaviour Potential rating categories by 2% across the DFA over a 10-year period.</p>
Description of target	AESRD has completed a landscape fire assessment on the DFA to identify the current status in regards to Fire Potential Behaviour. Canfor is able to reduce the Fire Potential Behaviour in adjacent Fire Community Zones and the DFA by harvesting stands assessed as extreme and high Fire Behaviour Potential (AESRD, 2015c).

Basis for the Target

Fires can spread very rapidly, especially given the strong winds that are common to the Grande Prairie region. These strong winds can easily carry embers several kilometers. Warm dry years in addition to the presence of dying MPB timber on the landscape can also exacerbate the potential of a momentous

fire occurrence. With this being said, forest fires have the potential to significantly impact communities located directly adjacent to forested Crown land.

In order to address and reduce the risk of forest fires from impacting communities, AESRD has developed a program called FireSmart that directs and guides government, home owners, and industry on strategies that can be implemented. “Designing FireSmart by integrating fire, forest, and land management planning activities is the cornerstone of protecting a multitude of values, achieving safety, meeting planning objectives, and ultimately attaining sustainable forest management” (AESRD, 2006a).

Means of Achieving Objective & Target (Strategies)

Through implementing the approved spatial harvest sequence, Canfor should achieve the targeted reduction in Fire Behaviour Potential of the FireSmart Community Zones and the DFA over a 10-year period.

Current Status

Table 56 FMA FireSmart Fire Behavior Potential

Fire Risk	Current Fire Risk		PFMS Year 10 Fire Risk		PFMS Year 20 Fire Risk		PFMS Year 50 Fire Risk	
	Area (Ha)	%	Area (Ha)	%	Fire Risk Reduction % From Current	Area (Ha)	%	Fire Risk Reduction % From Current
Non-Fuel	25,746	4.0%	25,343	3.9%	-0.1%	24,962	3.9%	-0.1%
Low Fire Behaviour Potential	179,832	27.9%	210,605	32.7%	4.8%	244,588	37.9%	10.0%
Moderate Fire Behaviour Potential	221,943	34.4%	205,425	31.9%	-2.6%	192,656	29.9%	-4.5%
High Fire Behaviour Potential	36,078	5.6%	33,065	5.1%	-0.5%	28,838	4.5%	-1.1%
Very High Fire Behaviour Potential	161,703	25.1%	151,911	23.6%	-1.5%	136,486	21.2%	-3.9%
Extreme Fire Behaviour Potential	19,393	3.0%	18,346	2.8%	-0.2%	17,164	2.7%	-0.3%
Total	644,695	100.0%	644,695	100.0%		644,695	100.0%	644,695

Table 57 Little Smoky FireSmart Community Zone Fire Behaviour Potential

Fire Risk	Current Fire Risk		PFMS Year 10 Fire Risk		PFMS Year 20 Fire Risk		PFMS Year 50 Fire Risk	
	Area (Ha)	%	Area (Ha)	%	Fire Risk Reduction % From Current	Area (Ha)	%	Fire Risk Reduction % From Current
Non-Fuel	274	4.0%	273	4.0%	0.0%	273	4.0%	0.0%
Low Fire Behaviour Potential	0	0.0%	439	6.4%	6.4%	496	7.2%	7.2%
Moderate Fire Behaviour Potential	5,420	78.7%	4,996	72.6%	-6.2%	4,957	72.0%	-6.7%
High Fire Behaviour Potential	1,107	16.1%	84	1.2%	-14.9%	81	1.2%	-14.9%
Very High Fire Behaviour Potential	84	1.2%	1,093	15.9%	14.7%	1,078	15.7%	14.4%
Total	6,884	100%	6,884	100%		6,884	100%	6,884

Table 58 Sturgeon Lake Clarkson Valley FireSmart Community Zone Fire Behaviour Potential

Fire Risk	Current Fire Risk		PFMS Year 10 Fire Risk		PFMS Year 20 Fire Risk		PFMS Year 50 Fire Risk	
	Area (Ha)	%	Area (Ha)	%	Fire Risk Reduction % From Current	Area (Ha)	%	Fire Risk Reduction % From Current
Non-Fuel	383	4.2%	382	4.2%	0.0%	382	4.2%	0.0%
Low Fire Behaviour Potential	6,755	73.8%	6,816	74.5%	0.7%	6,816	74.5%	0.7%
Moderate Fire Behaviour Potential	534	5.8%	529	5.8%	-0.1%	529	5.8%	-0.1%
High Fire Behaviour Potential	1,258	13.7%	220	2.4%	-11.3%	220	2.4%	-11.3%
Very High Fire Behaviour Potential	223	2.4%	1,206	13.2%	10.7%	1,206	13.2%	10.7%
Total	9,154	100%	9,154	100%		9,154	100%	9,154



Forecast

By following the “Means of Achieving Objective and Target (Strategies)” sections of this indicator, it is anticipated that the Fire Behaviour Potential of the FireSmart Community Zones and the DFA will be reduced as identified in Table 56, Table 57, & Table 58.

Legal Requirements

Alberta Forest Management Planning Standard, Annex 4 – Performance Standards 5.2.2.1

Monitoring & Measurement

Annual:

Cutblocks harvested will be overlaid with the Fire Behaviour Potential shapefile to identify % reduction in high and extreme Fire Behaviour Potential stands.

Reporting Process

Report in the 5 Year Stewardship Report the percent of reduction in Fire Behaviour Potential in the FireSmart Community Zones and the DFA.

Acceptable Variance

Reduction of Fire Behaviour Potential of the Fire Community Zones and the DFA must be within 0.5% of the target.

Response

If the target is not met, a root cause analysis will be completed to determine cause. Once cause is determined, the process may be modified.

10 PFMS, SHS Implementation, and Performance Monitoring and Reporting

10.1 Preferred Forest Management Scenario

Given that there are three forestry companies with timber allocations on the G15 Forest Management Unit (FMU), the planning process can be complicated by the different interests of each individual company. Although Canfor is the FMA holder and therefore bears responsibility for the forest management planning and timber supply analysis on the FMU, it was identified at the beginning stages of the FMP development that there are opportunities to create more operational efficiencies on the landscape and develop better relationships and communications between the three companies. It was also determined that modeling the FMA area as a single landbase²⁰ was the best approach to balance all of the ecological forest values as well as to maximize flexibility in the coniferous and deciduous timber supply.

Several key issues were identified by the companies during the planning process:

- Balancing competing values such as caribou, MPB, watersheds, oil and gas activity, etc., while managing the timber supply for two species is complex and challenging;
- Tolko's High Prairie OSB plant has been closed since 2008 and therefore has not been fully utilizing the deciduous volume allocated in their quota certificates;
- Tolko and Norbord both identified un-utilized volume from previous operating quadrants, in which they requested the volume to be reconciled into the 2015 timber supply analysis over the first 10-years;
- There is a need to reduce the amount of deciduous volume being sterilized on the FMA area and a desire from Canfor that all deciduous volume generated from C, CD, & DC blocks be a priority for utilization for ecological and economic reasons;
- There is a need for integrated operations as all companies will be operating in more mixedwood stands in the future; and
- All three companies have identified that deciduous stands with coniferous understory (Du) are important for maintaining timber supply into the future.

Throughout the Plan Development Team meetings and Mixedwood Management Technical Team meetings, the companies with direction from AESRD worked towards developing an approach that

²⁰ The FMA area timber supply was modeled as a single landbase, which means that the goal was to achieve a total coniferous and deciduous annual allowable cut for the area given all of the constraints applied. Areas and volumes of species were not designated by company or “secondary/incidental” vs. “primary” volumes when the PFMS was selected; all stands (D, DC, CD, C, and Du) contributed to both AAC’s. The PFMS generated one sustainable coniferous and deciduous AAC for the FMA area.

would best address each of these key issues along with the management strategies and assumptions described in Section 7. The result is the chosen PFMS.

Table 59 outlines the coniferous and deciduous annual allowable cuts based on the PFMS. As required by the AFMPS, Table 60 describes the historic and proposed timber allocations based on the PFMS. Figure 120 & Figure 121 show the PFMS 10 and 20-year spatial harvest sequence.

In comparison to the previous Healthy Pine Strategy, the analysis shows that there will not be a substantial mid-term decline with the implementation of the PFMS. This is primarily due to two factors:

- Canfor's focus on prioritizing operations to combat active MPB as well as AESRD level one activities have been effective in minimizing the non-recoverable losses associated with the MPB infestation and protecting the remaining pine growing stock. Based on these efforts the overall impact of the MPB has been substantially less than was previously anticipated and therefore the analysis results do not include any future losses of MPB growing stock; and
- Canfor was able to use better photography and tools for AVI interpretation, as well as an understory enhancement program, which helped identify more conifer understory in stands throughout the FMA area. This resulted in approximately 64,000 ha of conifer understory that was not identified in the previous AVI.

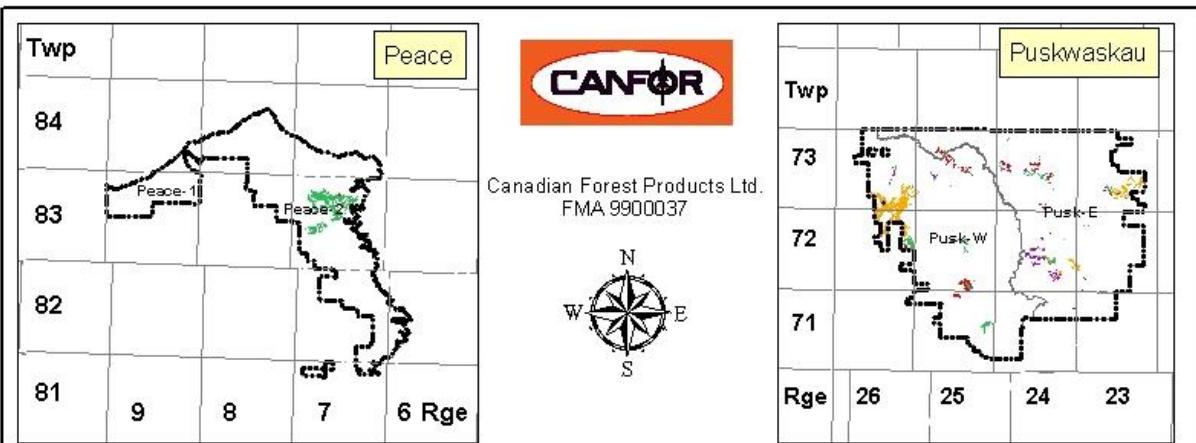
Table 59 PFMS 10 and 20-Year Coniferous and Deciduous AAC

Species	PFMS 10 Year AAC (m ³ /yr)	PFMS 20 Year AAC (m ³ /yr)
Conifer	714, 104	711, 988
Deciduous	564, 299	490, 003

Table 60 PFMS Timber Allocations

Historical Allocation										
Company Name	Disposition Number	FMU	Landbase Management Type	Effective Date of AAC	Deciduous (Decd) AAC (%)	Decid AAC (m3/yr)	Coniferous (Conifer) AAC (%)	Conifer AAC (m3/yr)		
Canfor	FMA 9900037	G15	FMA	May 2009 to May 2014	-	-	98.6%	705,000		
	-	G15	CTP	May 2009 to April 2014	-	-	1.4%	10,000		
Tolko	G150001	G15	DTA	May 2003 to April 2013	25.3%	114,712	-	-		
	G150002	G15	DTA	May 2004 to April 2024	37.1%	167,817	-	-		
Norbord	G150003	G15	DTA	May 2005 to April 2025	37.6%	170,000	-	-		
Total					452,529			715,000		
Proposed Allocations										
Company Name	Disposition Number	FMU	Landbase Management Type	Effective Date of AAC	Deciduous (Decd) AAC (%)	Decid AAC (m3/yr)	Coniferous (Conifer) AAC (%)	Conifer AAC (m3/yr)		
Canfor	FMA 9900037	G15	FMA	May 2014 to April 2024	-	-	98.6%	704,104		
	-	G15	CTP	May 2014 to April 2024	-	-	1.4%	10,000		
Tolko	G150001	G15	DTA	May 2014 to April 2024	68.5%	386,422	-	-		
	G150002	G15			31.5%	177,877	-	-		
Total					564,299			714,104		
Production										
Disposition Number	Cut Control Period	Periodic Cut Control AAC	Quadrant Date		Previous Quadrant Production (m3)	Quadrant Conifer Under-Production (m3)	Quadrant Decid Under-Production (m3)	Quadrant AAC		
FMA 9900037	1	3,525,000	May 2009 to April 2014		3,234,727	290,273	-	705,000		
CTP	1	50,000	May 2009 to April 2014		0	50,000	-	10,000		
Tolko	2	573560	May 2008 to April 2013		* Unknown	* Unknown	1,966,623	114,712		
	2	839085	May 2009 to May 2014					167,817		
Norbord	2	850000	May 2009 to May 2014		708,541		141,459	170,000		

*Unknown: Refer to Tolko Timber Production Audit



0 - 10 Year Preferred Forest Management Scenario Broad Cover Group

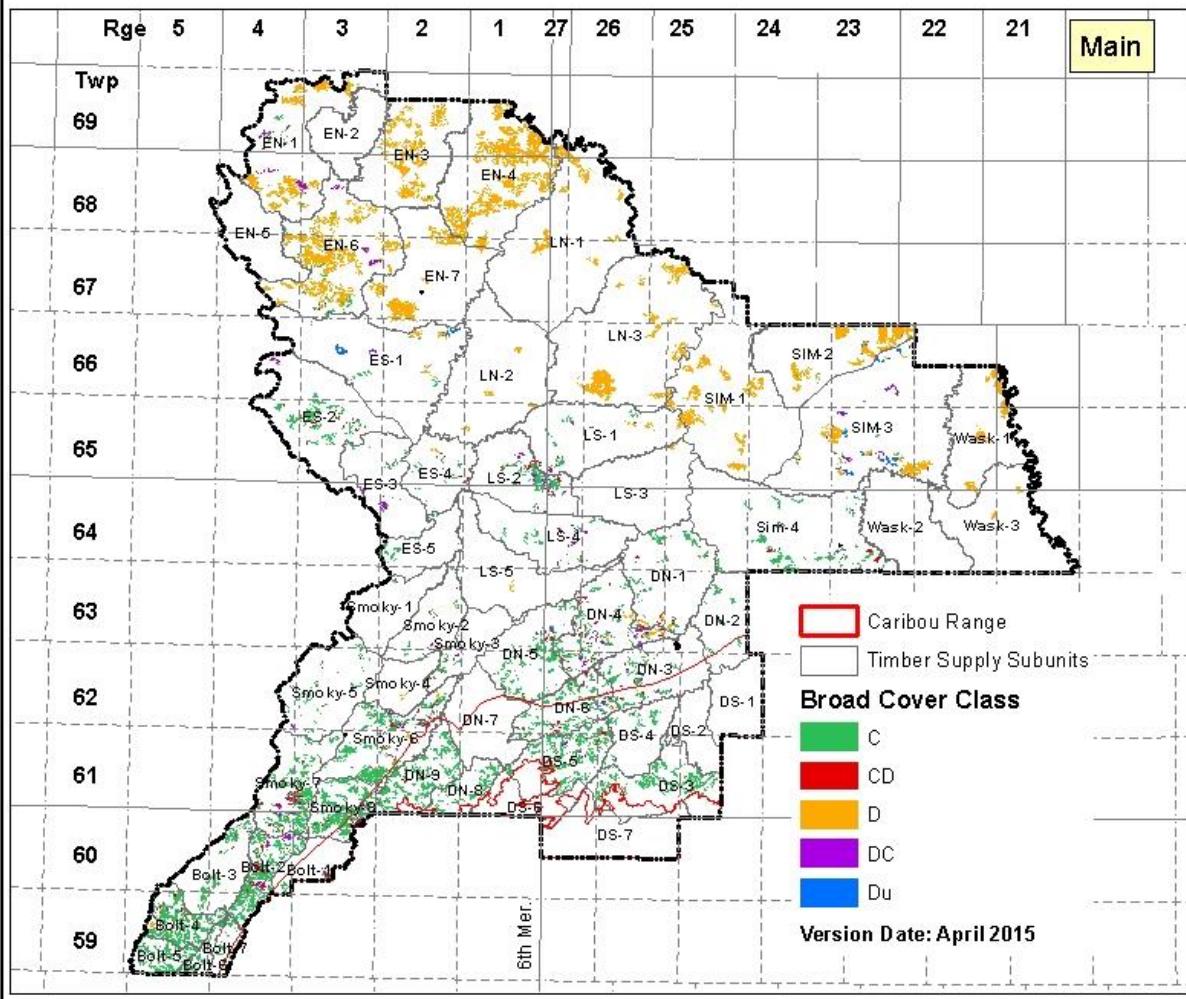


Figure 120 0-10 Year Preferred Forest Management Scenario Spatial Harvest Sequence

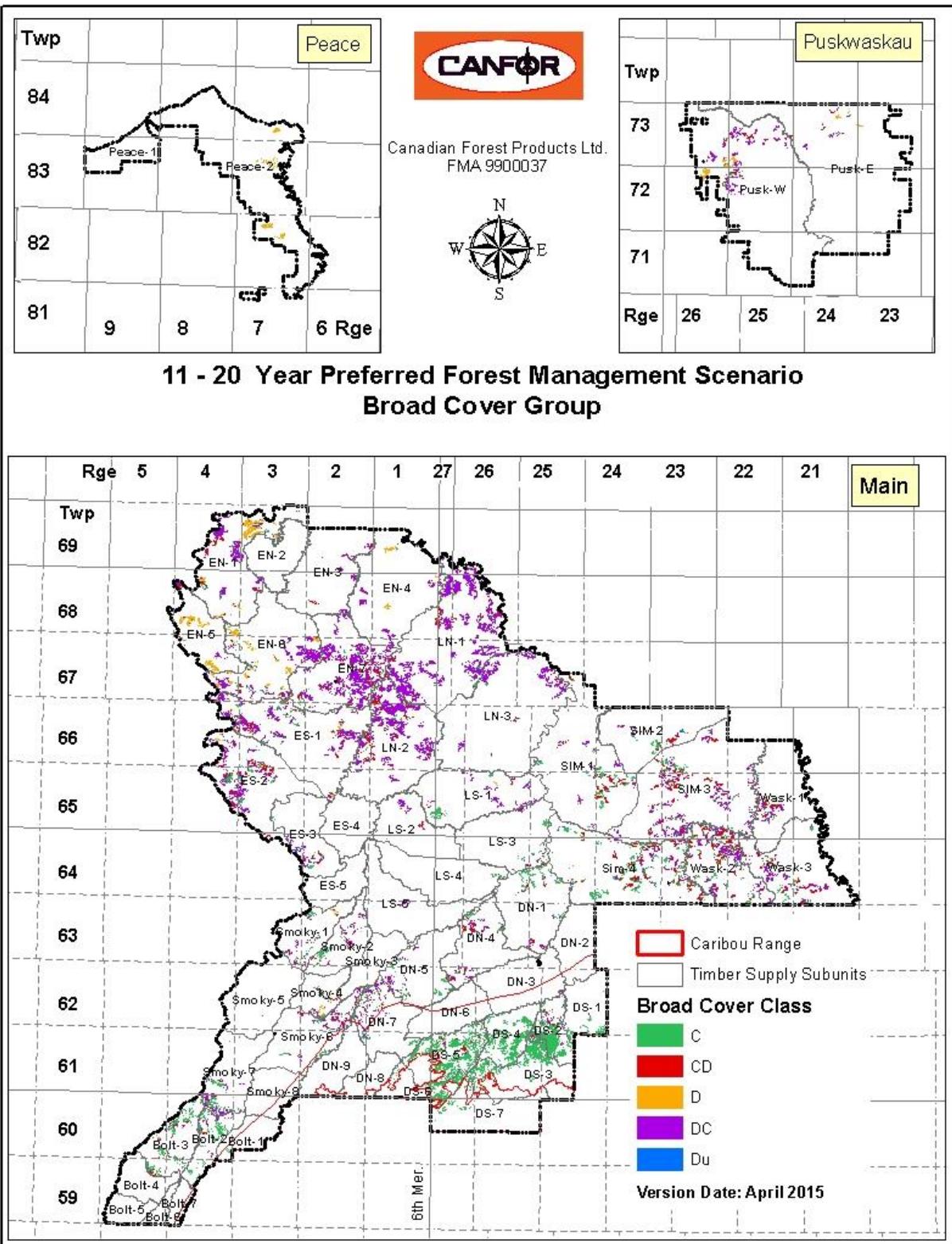


Figure 121 11-20 Year Preferred Forest Management Scenario Spatial Harvest Sequence

10.2 Spatial Harvest Sequence Implementation

10.2.1 RECONCILIATION VOLUME

Tolko and Norbord have both identified an underutilization of their allocated volumes from their last quadrants. Tolko identified a significant reconciliation volume due to the fact that they have not been operating since 2008 and requested that the volume be reconciled over a 10-year period.

AESRD directed the companies to model the reconciliation volume in the FMP timber supply analysis to ensure that it did not impact long term deciduous or coniferous harvest levels.

Initial timber supply scenarios proved that reconciling the full amount of underutilized volume over a 10-year period did affect the long-term sustainable levels. Through the modeling exercise, a maximum reconciliation volume (57% of the total underutilized volume) was identified which Norbord and Tolko split proportionally based on their approved deciduous timber allocations.

Table 61 Current DTA Allocations plus Reconciliation Volume (m³/year)

Company	DTA	Current Allocation Volume (m ³ /yr)	Total Volume (m ³ /yr)	% DTA Allocation	Reconciliation Volume (m ³ /yr)	Total 10 yr. AAC (m ³ /yr)	% with Reconciliation Volume
Norbord	G150003	170,000	170,000	37.6%	7,877	177,877	31.5%
Tolko	G150001	114,712					
	G150002	167,817	282,529	62.4%	103,893	386,422	68.5%
Total		452,529	452,529	100%	111,770	564,299	100%

Table 62 Current DTA Allocations plus Reconciliation Volume (m³/10yrs)

Company	DTA	Current 10yr. Allocation Volume (m ³)	Total 10yr. Volume (m ³)	% DTA Allocation	10 yr. Reconciliation Volume (m ³)	Total 10 yr. Allocation Volume (m ³)	% With Reconciliation Volume
Norbord	G150003	1,700,000	1,700,000	37.6%	78,770	1,778,770	31.5%
Tolko	G150001	1,147,120					
	G150002	1,678,170	2,825,290	62.4%	1,038,930	3,864,220	68.5%
Total		4,525,290	4,525,290	100%	1,117,700	5,642,990	100%

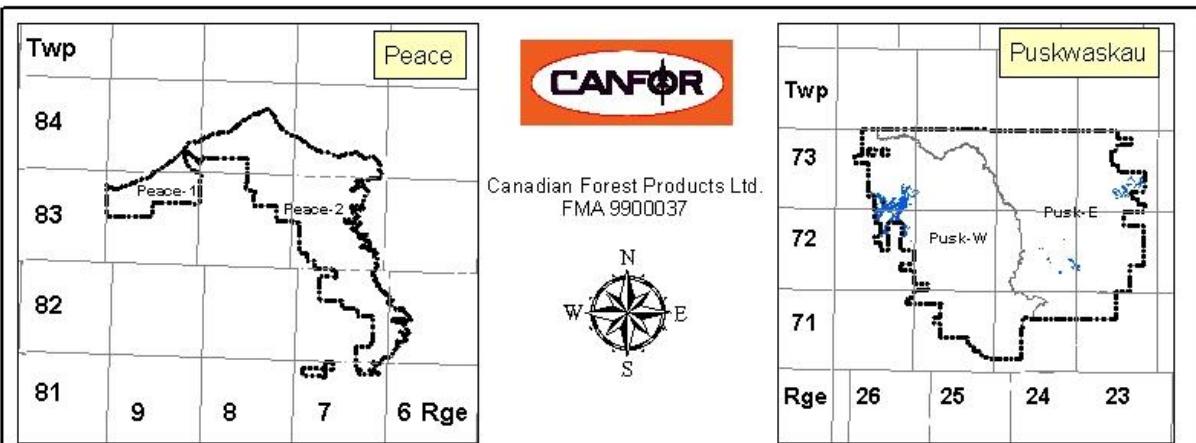
10.2.2 PFMS-DECIDUOUS VOLUME

The PFMS is able to achieve the allocated volumes of the deciduous companies with an additional reconciliation volume that does not impact the long term sustainability of the deciduous or coniferous harvest levels. Despite the Tolko OSB plant not operating, the PFMS is based on all three forest companies operating, which adds a certain complexity to the operational implementation of the spatial harvest sequence until Tolko's mill starts operating. Canfor, Norbord, and Tolko worked towards developing strategies to reduce the amount of sterilized volume left on the landscape as a result of Tolko not operating as well as to minimize the associated cost impacts to those companies currently operating.

Upon the selection of the PFMS, which was modeled as a single landbase, Tolko and Norbord worked together to select which sequenced stands each company would be tagged to in order to achieve their respective deciduous AACs (including reconciliation volume) in the first ten years (Table 62). The two companies identified areas of interest for the prime broad cover group “D” stands sequenced in the PFMS (Figure 122 & Figure 123 & Table 63).

Table 63 Pure Deciduous "D" 10-Year Volume Split Based on PFMS

TSU/TSS	Norbord (m ³)	Tolko (m ³)	Total (m ³)
Bolt	12,717		12,717
DN/DS		61,299	61,299
EN 1,6,7	1,259,838		1,259,838
EN3	203,594	184,122	387,716
EN4		953,715	953,715
ES	38,858		38,858
LN/LS/SIM		1,342,591	1,342,591
PUSK		300,088	300,088
SMOKY	41,750		41,750
WASK		152,803	152,803
PEACE			0
Total	1,556,756	2,994,618	4,551,374
Percent	34.2%	65.8%	100.0%



0 - 10 Year Preferred Forest Management Scenario Deciduous Company "D"

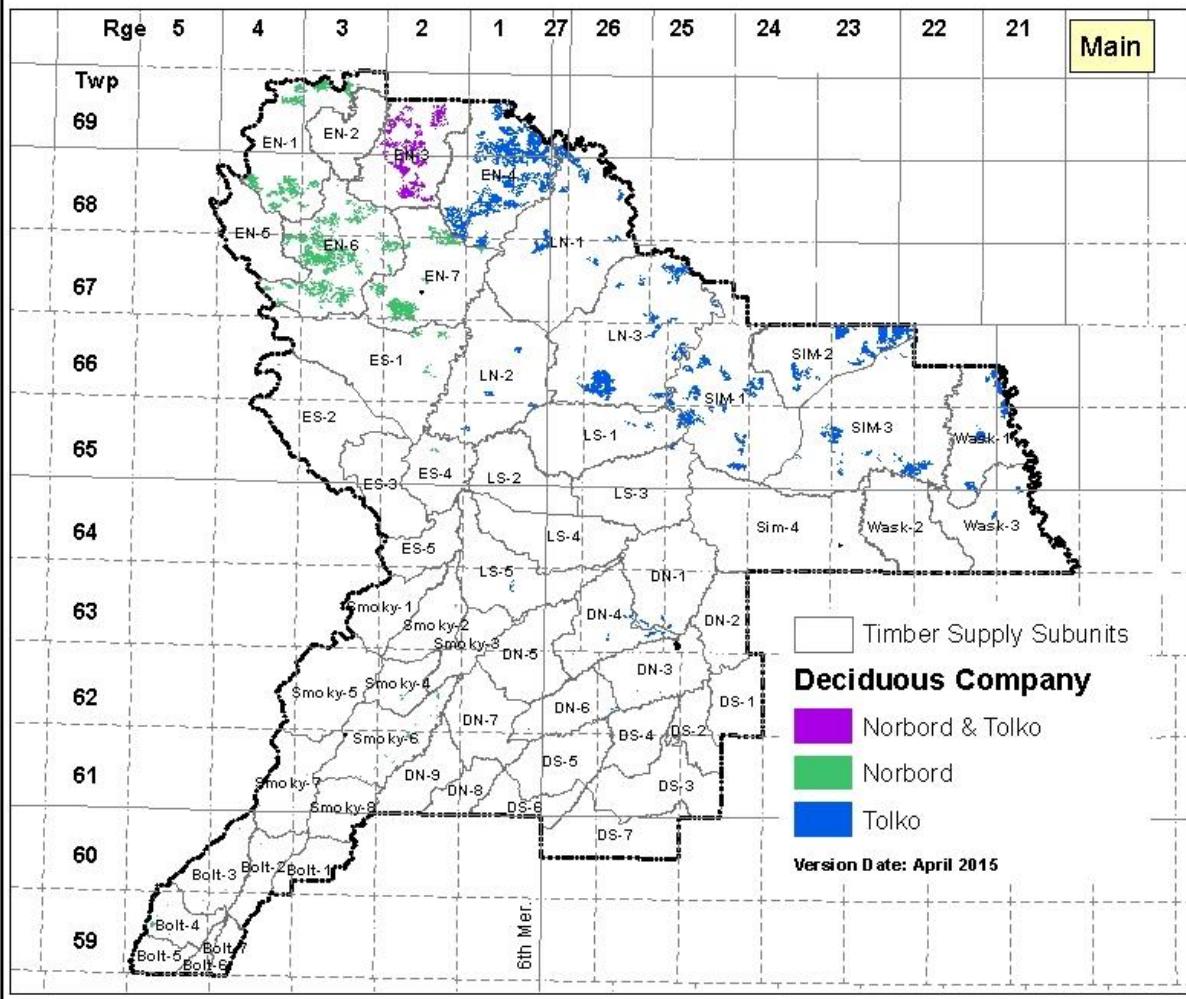
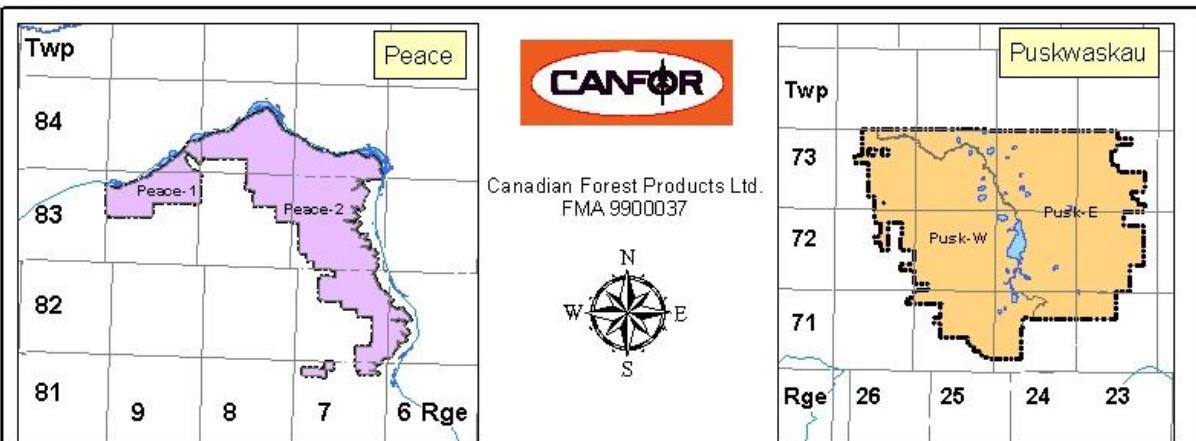


Figure 122 "D" 10-Year Preferred Forest Management Scenario SHS by Deciduous Company



Deciduous Companies "D" Areas

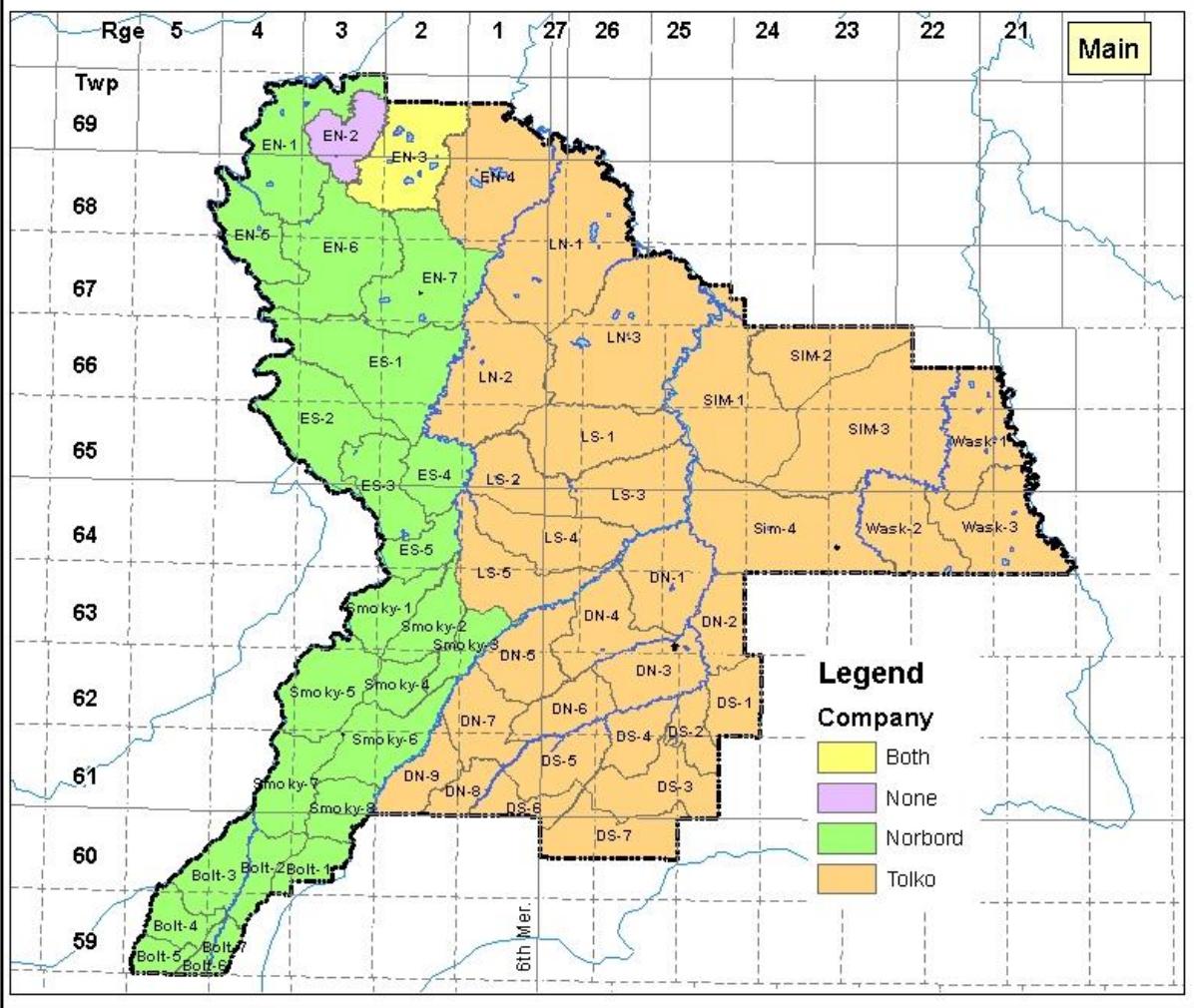


Figure 123 "D" Area by Company

It is agreed that the deciduous volume from C, CD, DC and Du sequenced stands will not be tagged to either deciduous company at this time in order to allow for greater flexibility to develop plans for the utilization of this volume in priority areas. However, preference will be given to the areas of interest identified by each company (Figure 123). Based on the “D” stands that Norbord and Tolko selected, the percent of deciduous volume from the C, CD, DC, and Du stands sequenced in the PFMS that each company will be allocated is calculated in Table 64. The deciduous timber drain for C, CD, DC and Du stands will be charged to Tolko and Norbord on a percentage basis and reconciled annually.

Table 64 Percent Deciduous Volume Chargeability (C, CD, DC, & Du)

	Norbord (m ³)	Tolko (m ³)	Total (m ³)
Total 10yr. Allocation plus Reconciliation Volume	1,778,770	3,864,220	5,642,990
Total 10yr. "D"	1,556,756	2,994,618	4,551,374
Remaining 10yr. (C, CD, DC & Du)	222,014	869,602	1,091,616
Percent (C, CD, DC & Du)	20.3%	79.7%	100.0%

The pure “D” Areas of Interest map will be used to provide some area of definition without compromising Canfor’s ability to find a home for secondary deciduous. Based on the areas of interest and deciduous volume from C, CD, DC, and Du stands sequenced in the PFMS, there will be a total of 534, 647m³ of deciduous volume from C, CD, DC, and Du stands available in Norbord’s area of interest, of which Norbord requires 222,014m³ to reach their total allocated volume. The balance of the deciduous volume sequenced in C, CD, DC, and Du stands in Norbord’s area of interest will be used by Tolko in addition to the 533, 932m³ of deciduous volume from C, DC, DC, and Du stands sequenced in Tolko’s area of interest. As long as Tolko’s High Prairie mill is not operating, Norbord will have access to the full amount of deciduous volume that Canfor is generating in the Norbord area of interest. During this time, if Norbord is interested in deciduous generated from C, CD, DC, and Du stands in Tolko’s area of interest, Tolko will be notified for agreement. This will be agreed to annually and/or until which time the Tolko High Prairie mill reopens.

A risk assessment scenario was completed which did not include Tolko operating to determine if there is a significant coniferous or deciduous timber supply impact. It was determined that there was not a significant impact to the timber supply, but that Norbord would need to take a larger proportion of their allocation from deciduous generated from C, CD, DC, and Du stands and less from “D” stands, which would be problematic for them operationally and economically.

Where feasible, integrated, FHPs, AOPs and harvest operations are key to the success of this plan and truly treating the FMA area as a single landbase. The above procedure has been mutually agreed to in order to implement this. The companies will be developing a memorandum of understanding to outline the operational implementation of the PFMS SHS. The AOP will identify which blocks each company will harvest and all responsibilities.

10.2.3 LINKAGE OF OPERATING GROUND RULES

All forest companies operating on the FMA area adhere to the current Operating Ground Rules for FMU G15 (Canfor, 2011b). The OGRs will be amended to ensure alignment with the approved FMP.



10.2.4 REFORESTATION

Canfor's 2015 Forest Management Plan Reforestation Strategy (Appendix G) details the reforestation strategy that will be implemented by Canfor, Norbord, and Tolko to achieve the proposed regenerated yield projections in the TSA.

10.2.5 GROWTH AND YIELD MONITORING PLAN

Canfor is committed to continue with all current growth and yield programs. The information derived from these programs is invaluable, as they provide local data that help validate management assumptions and practices.

The desire for a unified approach to growth and yield in Alberta and Western Canada led to the development of the Forest Growth Organization of Western Canada (FGrOW) in 2014. FGrOW will be the umbrella organization that will coordinate the programs of the founding associations which include the Foothills Growth and Yield Association (FGYA), Western Boreal Growth and Yield Association (Wesbogy), and the Alberta Forest Growth Organization (AFGO) of which Canfor is a member, as well as the Mixedwood Management Association. Canfor will be an active member of FGrOW and will continue to participate in existing programs of interest as well as new programs that may develop and be of interest to the company.

The Provincial Growth and Yield Initiative (PGYI), which was initiated through AFGO is a new program that Canfor is participating in. PGYI will be managed under the umbrella of FGrOW going forward. The goal of PGYI is to develop a provincial PSP database that includes standardized data from FMA areas across the province. This will aid in the exchange of data from different FMA areas located in similar biological/ecological subregions, as well as identify gaps in information for certain forest types, and create efficiencies when there are forest types that have been over-sampled in both natural and managed stands. The provincial PSP database will provide data for monitoring, model development, and validation or localization of yield estimates (AFGO, 2012). Canfor will standardize identified plots in its PSP and PHR programs to meet the PGYI requirements and submit the data to the provincial PSP database.

10.2.6 LONG-TERM ACCESS PLAN

Comprised of both company and external stakeholder infrastructure, Canfor's FMA area road network is both well established and secure. In the last decade, the energy sector has contributed significantly to access development on the FMA area. In support of the concept of minimizing the industrial footprint on the landscape, Canfor has attempted to integrate operations and access plans with external stakeholders where opportunities have arisen.

A majority of the spatial harvest sequence is accessible from the existing road infrastructure (Figure 124).

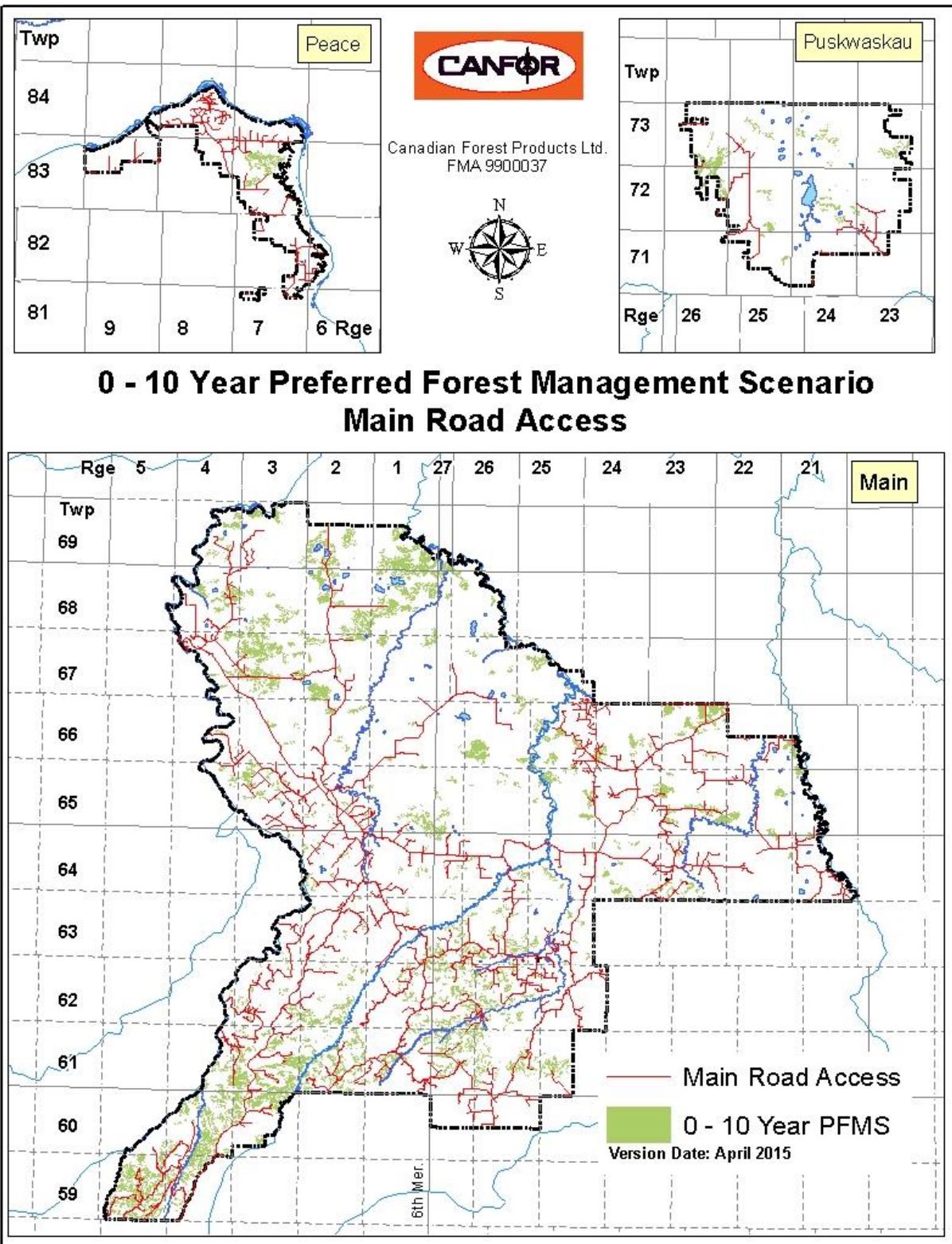


Figure 124 10-Year PFMS SHS Main Road Access

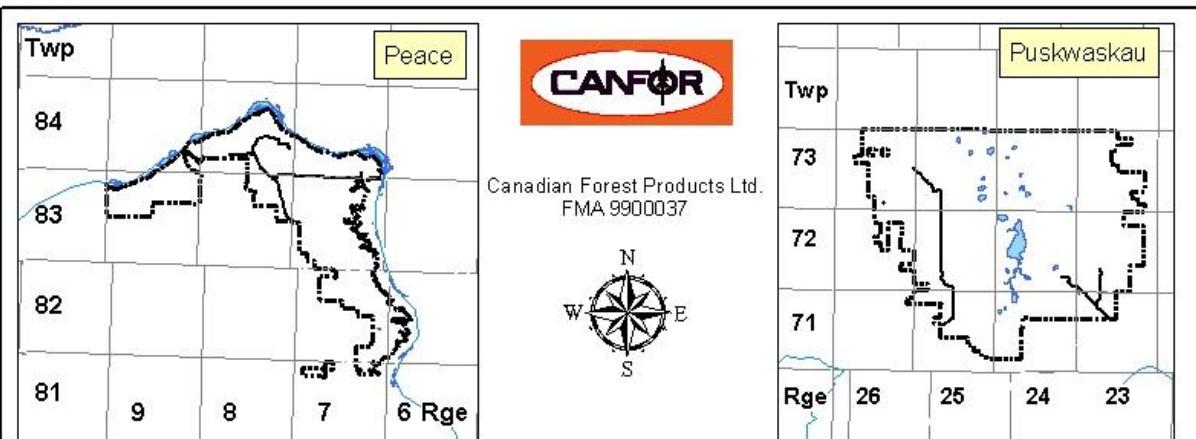
10.2.6.1 Proposed Long-term Access Development

In addition to the already existing road network, Canfor has identified an area in which additional long-term access may be required to bypass sections of the Forestry Trunk Road (FTR). The construction of this road system will provide access to undeveloped areas of the Spatial Harvest Sequence (SHS) and avoid imposed weight restrictions currently impeding the economic viability of some areas of the SHS.

Forestry Trunk Road (FTR) Bypass

Canfor has identified an alternate route bypassing the FTR and joining three of its critical off highway routes. The proposed developments are required in order to provide resolution of imposed municipal weight restrictions on the resource road which significantly impact Canfor economically and operationally.

Operational areas that would benefit from this access strategy are the Smoky and portions of the Bolton timber supply units west of the FTR and all timber supply units utilizing Canfor's 4000 road.



Proposed Long-term Access Development Plan

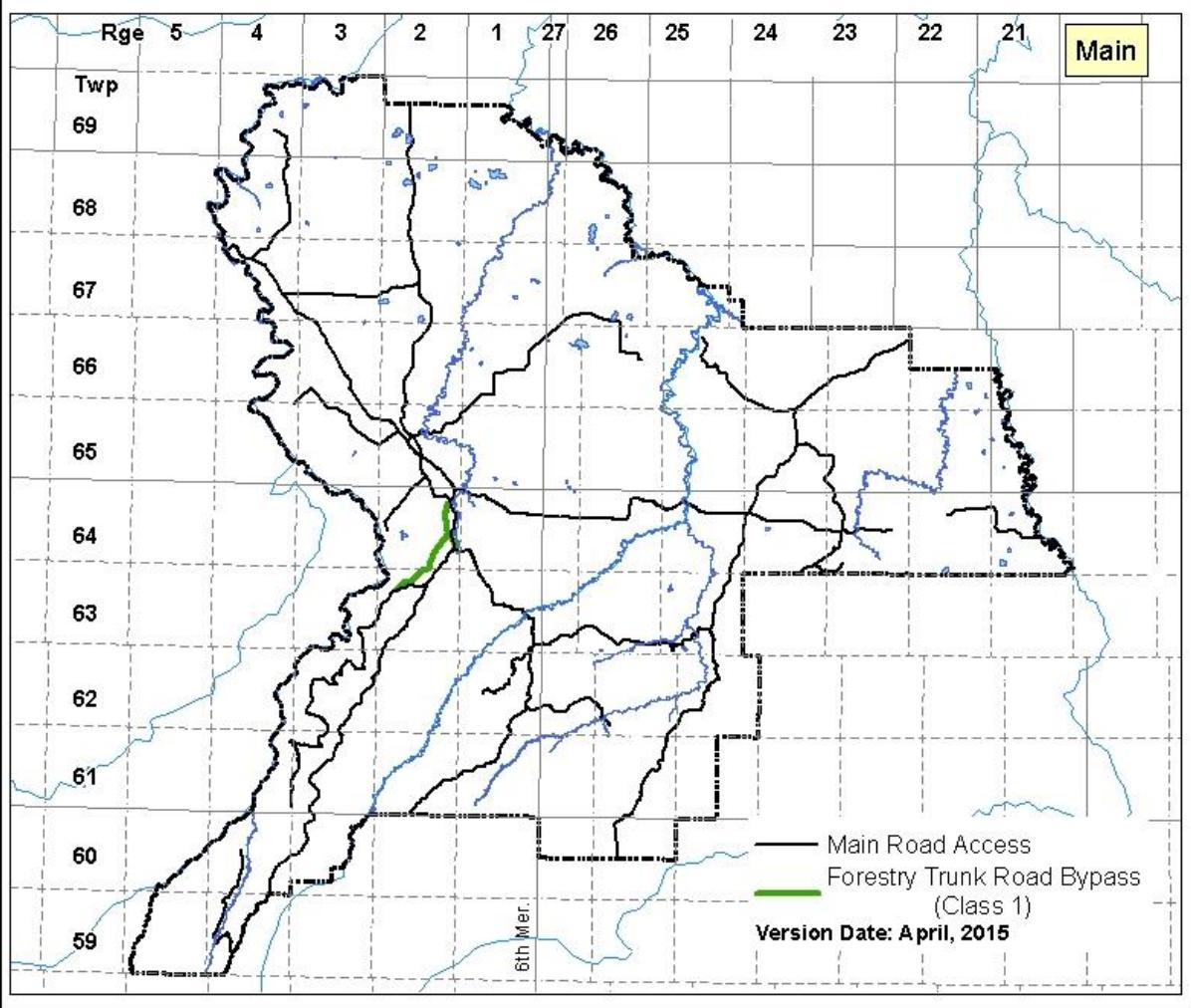


Figure 125 Proposed Long-term Access Development Plan

10.3 Performance Monitoring and Reporting

Performance Monitoring and Reporting will be conducted at both the operational and strategic levels through General Development Plan and Stewardship Reporting.

10.3.1 SPATIAL HARVEST SEQUENCE VALIDATION

10.3.1.1 Forest Harvest Plan Validation to SHS

The validation requirements for each Forest Harvest Plan Submission are outlined in section 3.4 of the current OGRs (Canfor, 2011b) and will be reported in the five year Stewardship Report.

10.3.1.2 Validation of Actual Harvest to SHS volume

To ensure that the sustainable harvest levels identified in the PFMS SHS are being implemented operationally, a post-harvest variance analysis will be completed at the end of each timber year after actual harvested boundaries have been interpreted from aerial photographs. Validation, as outlined below, will be completed prior to the end of the following timber year and reported in Canfor's General Development Plan and the Five Year Stewardship Report.

- a. Harvested delivered volume to forecasted volumes by timber supply subunit to validate projected yields;
- b. The area and volume harvested compared to the THLB;
- c. Harvest area internal to the THLB;
- d. Harvest area external to the THLB; and
- e. Internal non-harvested retention.

10.3.2 OPERATIONAL ADJUSTMENTS

10.3.2.1 Retention

Through the implementation of the strategy described in Section 7.2.1.1.5, the amount of retention left on the FMA area should meet the targets identified in VOIT 1.1.4a (refer to Section 9 for alignment with Annex 4). The amount of representative merchantable area in the form of patches and single tree retention will be identified and calculated annually after retention areas are mapped from Aerial photographs. The amount of merchantable volume retained on the landscape as retention will be drained annually from the AAC.

10.3.2.2 Merchantable Timber Used for Watercourse Crossings

Annually at the end of the timber year, harvesting supervisors report the amount of merchantable cubic meters used for crossings on the Crossing Volume Drain worksheet to AESRD Timber Production, Auditing and Revenue Section.

10.3.2.3 Timber Salvage

Roads, well sites, processing plants, power lines, pipelines, and gravel pits are all examples of dispositions (permanent land withdrawals) where salvage timber may be generated. In accordance with Alberta Environment Sustainable Resource Development (AESRD) *Directive No. 2008-03: Industrial Timber Salvage Chargeability*, "A forest tenure holder has the right to its share of salvage volumes based

on its tenure allocation as specified in its tenure documents" (AESRD, 2008b). Industrial timber salvage is chargeable production to the forest tenure holder's AAC.

There are three options identified for determining timber volumes:

- Provincial Timber Damage Volume Tables;
- FMA/FMU Specific Volume Tables; and
- Weigh Scale Method.

For this plan the weigh scale method will be used.

The chargeable volume of timber will follow procedures identified in *Procedure B.2 Scaled Chargeability of the Industrial Timber Salvage Chargeability Directive*. These are:

- *By mutual agreement with all tenures, each tenure holder agrees to accept industrial salvage volumes with the volumes being chargeable production based on the amount of timber delivered and scaled at their mill;*
- *Only scaled volume for industrial dispositions within the FMA in which the tenure holder has rights will be assessed as chargeable production;*
- *Where the tenure holder waives or opts not to accept merchantable timber salvage from within the FMA in which the tenure holders has timber rights this un-used volume will be chargeable production based on one of the two table approaches; and*
- *The use of this method requires the tenure holders within the FMA to develop and implement a tracking system for the industrial dispositions which includes the disposition and Forest Management Unit (FMU) (AESRD, 2008b).*

For this FMP, FMA/FMU specific volume tables will be used.

Canfor has established procedures to track the volume of salvage wood originating from the FMA area. Other companies desiring dispositions within the FMA area must obtain consent from Canfor and, prior to conducting their operations, must sign a salvage commitment form indicating whether the salvage has been accepted or declined by Canfor. These transactions are recorded in the Land-use Database, which has the capability to track a number of salvage components. Based on a recent query of the database for 2009-2013, salvage wood has been hauled from 97% of the reported dispositions.

10.3.2.4 Timber Drain Validation

To ensure proper timber drain, a post-harvest calculation will be completed at the end of each timber year after actual harvested boundaries have been interpreted from aerial photographs. Verification, as outlined below, will be completed prior to the end of the following timber year and reported to AESRD in the Timber Production and Revenue System.

- a. Total volume harvested;
- b. Determine the amount non-THLB volume harvested;
- c. Determine the amount of THLB merchantable internal non-harvested structural retention;

- d. Determine the proximal merchantable volume using AVI volumes that will not be harvested for one rotation that was part of the THLB;
- e. Determine the amount of merchantable volume used for crossings; and
- f. Calculate the volume difference for conifer and deciduous ($a-b+c+d+e=f$).

10.4 Five Year Stewardship Report

Canfor is committed to sustainable forest management and operating under an adaptive management regime. Monitoring and stewardship reporting are an important component of the 2015 FMP. Sustainable forest management rests on Canfor's ability to predict, to some degree, the future forest conditions resulting from various management plans and practices. Monitoring provides the necessary feedback on those predictions, and supports adaptive management. Through the monitoring required for Canfor's CSA certification and AESRD's stewardship reporting, data will be collected to learn more about the forest and, based on this "new" knowledge, management of the forest resources will improve.

Canfor will continue monitoring and reporting performance annually to meet CSA certification commitments and will submit a Five Year Stewardship Report to AESRD based on performance specific to this FMP in 2019.



11 Works Cited

(n.d.). Retrieved April 15, 2015

AESRD. (1995-2015). *Fish Creek Provincial Park*. Retrieved February 27, 2015, from Alberta Parks: <http://www.albertaparks.ca/fish-creek/park-research-management/invasive-plants.aspx>

AESRD. (2001). *Directive No. 2001-06 Weed Management in Forestry Operations*. Edmonton: Alberta Sustainable Resource Development Land & Forest Division.

AESRD. (2005). *Status of Arctic Grayling (Thymallus arcticus) in Alberta*. Edmonton: Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 57.

AESRD. (2006a). Alberta Forest Management Planning Standard Ver 4.1. Edmonton: Alberta Sustainable Resource Development-Public Lands and Forests Division Forest Management Branch.

AESRD. (2006b). *Interpretive Bulletin: Planning Mountain Pine Beetle Response Operations ver. 2.6*. Edmonton: Alberta Environment and Sustainable Resource Development.

AESRD. (2007). *Directive No. 2007-01: Fire Salvage Planning and Operations*. Edmonton: Alberta Environment and Sustainable Resource Development Forest Management Branch.

AESRD. (2008a). *Alberta Grizzly Bear Recovery Plan 2008-2013*. Edmonton: Alberta Sustainable Resource Development, Fish and Wildlife Division.

AESRD. (2008b). *Directive No. 2008-03: Industrial Timber Salvage Chargeability*. Edmonton: Alberta Environment and Sustainable Resource Development Forest Management Branch.

AESRD. (2009). *The Home Owners Fire Smart Manual 4th Edition*. Edmonton: Alberta Environment and Sustainable Resource Development. Retrieved April 3, 2015, from ESRD-Wildfire: <http://www.wildfire.alberta.ca/fire-smart/documents/Firesmart-HomeownersManual-ProtectYourHomeFromWildfire.pdf>

AESRD. (2010a, August 4). Canfor FMP Pre-Consultation Assessment Letter. Grande Prairie: Government of Alberta Sustainable Resource Development.

AESRD. (2010b). *Forest Bio-fibre, Carbon, Carbon Sequestration Benefits*. Retrieved April 26, 2015, from <http://esrd.alberta.ca/lands-forests/forest-business/documents/ForestBiofibreCarbonSequestrationBenefitsApr2010.pdf>

AESRD. (2010c). *Watershed Hazard Assessment Application*. Edmonton: Alberta Environment and Sustainable Resource Development.

- AESRD. (2011a). *Technical Guidance for Offset Protocol Developers*. Retrieved April 26, 2015, from <http://esrd.alberta.ca/focus/alberta-and-climate-change/regulating-greenhouse-gas-emissions/alberta-based-offset-credit-system/offset-credit-system-protocols/documents/TechnicalGuideOffsetProtocol-Jan2011.pdf>
- AESRD. (2011b). *The Equivalent Clearcut Area Method of Watershed Assessment for Forest Management Plans*. Edmonton: Alberta Environment and Sustainable Resource Development.
- AESRD. (2012). *Bull Trout Conservation Management Plan 2012-2017*. Edmonton: Government of Alberta Sustainable Resource Development, Species at Risk Conservation Management Plan No.8.
- AESRD. (2013). *Wildfire Alberta*. Retrieved March 24, 2015, from Government of Alberta: <http://wildfire.alberta.ca/wildfire-maps/documents/WildfireManagementAreas-2013.pdf>
- AESRD. (2014a). *Alberta Parks*. Retrieved March 26, 2015, from Alberta.ca: <http://www.albertaparks.ca/albertaparksca.aspx>
- AESRD. (2014b). *Reforestation Standard of Alberta*. Edmonton: Alberta Environment and Sustainable Resource Development.
- AESRD. (2014c, April). *Spatial Wildfire Data*. Retrieved March 24, 2015, from Alberta Environment and Sustainable Resource Development: <http://wildfire.alberta.ca/wildfire-maps/historical-wildfire-information/spatial-wildfire-data.aspx>
- AESRD. (2015a). *Alberta-based Offset Credit System*. Retrieved April 26, 2015, from <http://esrd.alberta.ca/focus/alberta-and-climate-change/regulating-greenhouse-gas-emissions/alberta-based-offset-credit-system/default.aspx>
- AESRD. (2015b). *Caribou Action & Range Planning FAQs*. Retrieved March 15, 2015, from Alberta Environment and Sustainable Resource Development: <http://esrd.alberta.ca/fish-wildlife/wildlife-management/caribou-management/caribou-action-range-planning/caribou-action-range-planning-faqs.aspx>
- AESRD. (2015c). *Canadian Forest Products Limited Grande Prairie FireSmart Management*. Edmonton: Alberta Environment and Sustainable Resource Development Forestry and Emergency Response Division Wildfire Management Branch.
- AESRD. (2015d, March 31). Canfor FMP Pre-Consultation Assessment Amendment Letter. Grande Prairie: Alberta Environment and Sustainable Resource Development.
- AFGO. (2012). *Framework for Alberta Growth and Yield Plans*. Alberta Forest Growth Organization.
- Alberta Caribou Recovery Team. (2005). Alberta woodland recovery plan 2004/05-20013/14. *Alberta Species at Risk Recovery Plan No.4*, 48 pp.

- Alberta Offset Registry. (2015). *Canfor Grande Prairie Sawmill Biomass Energy Project*. Retrieved April 26, 2015, from http://www.csaregistries.ca/albertacarbonregistries/eor_project.cfm?id=%23%2C%230M%0A
- Allen, C., Macalady, A., Chenchouni, H., Bachelet, D., McDowell, N., Vennetier, M., . . . Cobb, N. (2010). A Global Overview of Drought and Heat-induced Tree Mortality Reveals Emerging Climate Change Risks for Forests. *Forest Ecology and Management* 259(4), pp. 660-684.
- Altamira Consulting Ltd. (1998). *Historical Resources Overview Assessment: 1998 Canfor Forest management Units*. Grande Prairie: Prepared for Canfor, Alberta Region, Grande Prairie Operations.
- Amiro, B., Cantin, A., Flannigan, M., & Groot, W. (2009). Future Emissions from Canadian Boreal Forest Firest. *Canadian Journal of Forest Research*, 39,383-395 pp.
- Andison, D. (1997). *Landscape Fire Behavious Patterns on the Foothills Model Forest*. Colorado.
- Andison, D. (2000). *Integrating Natural Pattern Knowledge into Management: Issues and Opportunities*. Retrieved March 3, 2015, from UBC: http://ibis.geog.ubc.ca/courses/geob479/notes/landscape_ecology/andison.pdf
- AWN. (2015). *Aseniwuche Winewak Nation of Canada-Ancestral History*. Retrieved March 30, 2015, from Aseniwuche.com: http://www.aseniwuche.com/our_story/ancestral_history.html
- Balshi, M., McQuire, A., Duffy, P., Flannigan, M., Kickligher, D., & Melillo, J. (2009). Vulnerability of Carbon Storage in North American Boreal Forests to Wildfires During the 21st Century. *Global Change Biology*, 15, 1491-1510 pp.
- Benn, B., & Herrero, S. (2002). Grizzly bear mortality and human access in Banff and Yoho National Parks, 1971-1998. *Ursus* 13:213-221 pp.
- Bentz, B., Régnière, J., Fettig, C., Hansen, E., Hayes, J., Hicke, J., . . . Seybold, S. (2010). Climate Change and Bark Beetles of the Western United States and Canada: Direct and Indirect Effects. *BioScience*, 60(8), 602-613.
- Berland, A., Nelson, T., Stenhouse, G., Graham, K., & Cranston, J. (2008). The impact of landscape disturbance on grizzly bear habitat use in the Foothills Model Forest, Alberta, Canada. *Forest Ecology and Management*, 256:1875-1883 pp.
- Bonan, G. (2008). Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests. *Science*, 320(5882), pp. 1444-1449.
- Boulanger, J., & Stenhouse, G. (2014). The Impacts of Roads on the Demography of Grizzly Bears in Alberta. *PLoS ONE*, 9:22 pp.

- Bradford, J. (2011). Potential Influence of Forest Management on Regional Carbon Stocks: An Assessment of Alternative Scenarios in the Northern Lake States, USA. *Forest Science*, 57(6), 479-488 pp.
- Bunnell, F., & Vernier, P. (2007). *Vertebrate Species Accounting System for the Radium DFA*. Vancouver: Centre for Applied Conservation Research University of British Columbia.
- Canadian Forest Service. (2013). Forest Carbon Accounting-The CBM-CFS3. CBM-CFS3 Training Workshop. Lecture conducted from Natural Resources Canada, Victoria, British Columbia, Canada.
- Canfor. (1998). *Canfor Public Recreation Areas (Brochure)*. Grande Prairie: Canadian Forest Products Ltd.
- Canfor. (2003). *Detailed Forest Management Plan 2001 (revised 2003)*. Grande Prairie: Canadian Forest Products Ltd.
- Canfor. (2005). *Canfor's SFMP CAN/CSA Z809-02*. Grande Prairie: Canadian Forest Products Ltd. Grande Prairie Division.
- Canfor. (2009). *Healthy Pine Strategy: Amendment for Canfor's 2003 Detailed Forest Management Plan*. Grande Prairie: Canadian Forest Products. Ltd Grande Prairie Division.
- Canfor. (2010). *Terms of Reference 2012 Forest Management Plan for Canfor FMA 9900037*. Grande Prairie: Canadian Forest Products Ltd. Grande Prairie Division.
- Canfor. (2011a, May). *Environment Policy*. Vancouver, British Columbia: Canadian Forest Products Ltd.
- Canfor. (2011b). *Canfor FMA 9900037 Operating Ground Rules-FMU G15*. Grande Prairie: Canadian Forest Products Ltd. Grande Prairie Division.
- Canfor. (2011c). *Canfor_Common_Indicator_Matrix*. Prince George: Canadian Forest Products Ltd.
- Canfor. (2012a). *Canadian Forest Products Ltd. Alberta Region Trapper Consultation Program*. Grande Prairie: Canadian Forest Products Ltd.
- Canfor. (2012b). *Erosion and Sediment Control*. Grande Prairie: Canadian Forest Products Ltd. Alberta Operations.
- Canfor. (2012c). *Sustainable Forest Management Commitments*. Vancouver: Canadian Forest Products Ltd.
- Canfor. (2013). *Public Involvement Program for Canadian Forest Products Ltd. FMA #9900037*. Grande Prairie: Canadian Forest Products Ltd. Grande Prairie Division.
- Canfor. (2014a). *Sustainable Forest Management Plan 2012 (Revised April 2014)*. Grande Prairie: Canadian Forest Products Ltd. Grande Prairie Division.



Canfor. (2015a). *Canadian Forest Products Ltd. Alberta Operations 2015 Forest Protection Plan*. Grande Prairie: Canadian Forest Products Ltd. Alberta Operations.

Canfor. (2015b). *Canadian Forest Products Ltd. Forest Management Agreement 9900037 2015 Forest Management Plan First Nations Consultation Plan*. Grande Prairie: Canadian Forest Products Ltd. Grande Prairie Division.

Canfor. (2015c). *Energy-Lumber Operations*. Retrieved from Canfor.com:
<http://www.canfor.com/energy/lumber-operations>

CBFA. (2010). *The Canadian Boreal Forest Agreement*. Ottawa: Canadian Boreal Forest Agreement.

CBFA. (2014a). *CBFA Forestry Requirements for Natural Range of Variation (NRV) Analysis and Target Setting*. Ottawa: CBFA Secretariat.

CBFA. (2014b). *Status Report on Ecosystem-Based Management (EBM) Policy Barriers and Opportunities for EBM in Canada*. Ottawa: Canadian Boreal Forest Agreement.

CCFM. (1997). *Criteria and Indicators of Sustainable Forest Management in Canada: Technical Report*. Ottawa: Canadian Council of Forest Ministers.

CCFM. (2003). *Defining Sustainable Forest Management in Canada Criteria and Indicators 2003*. Ottawa: Canadian Council of Forest Ministers.

Cerezke, H., Dhir, N., & Barnhardt, L. (2013). *Review of Insect and Disease Challenges to Alberta Coniferous Forests in Relation to Resistance Breeding and Climate Change*. Edmonton: Alberta Environment and Sustainable Resource Development, Forest Management Branch. Retrieved from <http://esrd.alberta.ca/lands-forests/forest-health/forest-pests/documents/InsectDisease-ConiferousForests-2013.pdf>

Ciarniello, L., Boyce, M., Heard, D., & Seip, D. (2005). Denning behaviour and den site selection of grizzly bears along the Parsnip River, British Columbia, Canada. *Ursus*, 16:47-58 pp.

Ciarniello, L., Boyce, M., Seip, D., & Heard, D. (2007). Grizzly Bear Habitat Selection is Scale Dependent. *Ecological Applications*, 17: 1424-1440 pp.

Clark, T., Paquet, P., & Curlee, A. (1996). General Lessons and Positive Trends in Large Carnivore Conservation. *Conservation Biology*, 10:1055-1058 pp.

Covey, K., & Orefice, J. (2009). The Physiological Ecology of Carbon Science in Forest Stands. *Forests and Carbon: A Synthesis of Science, Management, and Policy for Carbon Sequestration in Forests*.

Cox, P., Betts, R., Jones, C., Spall, S., & Totterdell, I. (2000). Acceleration of Global Warming Due to Carbon-Cycle Feedbacks in a Coupled Climate Model. *Nature*, 408, 184-187 pp.

Crosina, W. (2014). FRIAA Proposal: Historical Landscape Condition Benchmarks for Northwestern Alberta. Grande Prairie.

CSA. (2008). *CAN/CSA-Z809-08 Sustainable Forest Management*. Mississauga, ON: Canadian Standards Association.

Dale, V., Joyce, L., McNulty, S., Neilson, R., Ayres, M., Flannigan, M., . . . Wotton, B. (2001). Climate Change and Forest Disturbances: Climate Change can Affect Forests by Altering the Frequency, Intensity, Duration, and Timing of Fire, Drought, Introduced Species, Insect and Pathogen Outbreaks, Hurricanes, Windstorms, Ice Storms, or Landslides. *BioScience*, 51(9), 723-734.

Delibes, M., Gaona, P., & Ferreras, P. (2001). Effects of an attractive sink leading into maladaptive habitat selection. *Am Nat*, 158:277-285 pp.

Downing, D., & Pettapiece, W. (2006). *Natural Regions and Subregions of Alberta: Natural Regions Committee*. Edmonton: Government of Alberta.

Engel, B. (2006). *Recreational Assessment of Six Campsites Managed by Canadian Forest Products Ltd. 2003-2005*. Grande Prairie.

Environment Canada. (2012). Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population in Canada. *Species at Risk Act Recovery Series*, 38-39.

Environment Canada. (2013). Bird conservation strategy for Bird Conservation Region 6: Boreal Taiga Plains. 34 pp.

Environment Canada. (2014). *National Inventory Report 1990-2012: Greenhouse Gas Sources and Sinks in Canada*. Ottawa: Environment Canada.

Environment Canada. (2015a). *Canada's Action on Climate Change*. Retrieved April 26, 2015, from Environment Canada: http://www.climatechange.gc.ca/Content/7/2/F/72F16A84-425A-4ABD-A26E-8008B6020FE7/2674_COP20_ClimateC_action_factsheet_E_05.pdf

Environment Canada. (2015b). *Incidental Take of Migratory Birds in Canada*. Retrieved April 16, 2015, from Environment Canada: <http://ec.gc.ca/paom-itmb/default.asp?lang=En&n=C51C415F-1>

Environment Canada. (2015c). *Water Office*. Retrieved April 1, 2015, from Environment Canada: https://wateroffice.ec.gc.ca/google_map/google_map_e.html?searchBy=p&province=AB&doSearch=Go

Falkowski, P., Scholes, R., Boyle, E., Canadell, J., Canfield, D., Elser, J., . . . Steffen, W. (2000). The Global Carbon Cycle: A Test of our Knowledge of Earth as a System. *Science*, 290(5490), 291-296 pp.

Field, C., Lobell, D., Peters, H., & Chiariello, N. (2007). Feedbacks of Terrestrial Ecosystems to Climate Change. *Annual Review of Environment and Resources*, 32, 1-29 pp.

FMAC. (2015). *Forest Management Advisory Committee Terms of Reference*. Grande Prairie: Canadian Forest Products Ltd. Grande Prairie Division.



FRI. (2014). *Foothills Research Institute Grizzly Bear Program User Guide: 2014 Deliverables*. Hinton: Foothills Research Institute.

Galik, C., & Jackson, R. (2009). Risks to Forest Carbon Offset Projects in a Changing Climate. *Forest Ecology and Management*, 257(11), 2209-2216 pp.

Gibeau, M., Clevenger, A., Hererro, S., & Wierzchowski, J. (2002). Grizzly bear response to human development and activities in the Bow River Watershed, Alberta, Canada. *Biological Conservation*, 103:227-236 pp.

GoA. (2008). *Land-use Framework*. Edmonton: Government of Alberta.

GoA. (2011). *Grazing and Timber Integration Manual*. Edmonton: Government of Alberta.

GoA. (2011). *Weed Control Act*. Edmonton: Alberta Queen's Printer.

GoA. (2011a, August). *Public Lands Administration Regulation*. Edmonton, Alberta: Alberta Queen's Printer.

GoA. (2013). *Fire Control Agreement*. Edmonton: Government of Alberta.

GoA. (2014 a.). *Forests Act*. Edmonton: Alberta Queen's Printer.

GoA. (2014 b.). *Public Lands Act*. Edmonton: Alberta Queen's Printer.

GoA. (2015). *Wildlife Management Review of the Canfor FMP Grizzly Bear Non Timber Assessment Results*. Edmonton: Government of Alberta.

GoA. (2015a). *Alberta Aboriginal Relations*. Retrieved April 11, 2015, from Government of Alberta: <http://www.aboriginal.alberta.ca/1039.cfm>

GoA. (2015b). *Forest Management Agreement (O.C. 012/2015)*. Edmonton: Government of Alberta.

Grande Prairie Tourism Association. (2014). *Grande Prairie and Region 2014 Official Guide Celebrating 100 Years*. Retrieved March 29, 2015, from GP Tourism: http://issuu.com/gptourism/docs/gprta_-_367480_for_web/91?e=1

Harkema, J., & Scott, M. (2002). *Silvicultural Systems Program Notes to the Field*.

Heritage Community Foundation. (2010). *The Boreal Forest Region*. Retrieved February 24, 2015, from <http://wayback.archive-it.org/2217/20101208161018/http://www.abheritage.ca/abnature/boreal/boreal.htm#>

Hervieux, D., Hebblewhite, M., DeCesare, N., Russell, M., Smith, K., Robertson, S., & Boutin, S. (2013). Widespread Declines in Woodland Caribou (*Rangifer tarandus caribou*) Continue in Alberta. *Canadian Journal of Zoology*, 91(12): 872-882.

- Hervieux, D., Hebblewhite, M., Stepnisky, D., Bacon, M., & Boutin, S. (2014). Managing Wolves (*Canis lupus*) to Recover Threatened Caribou (*Rangifer tarandus caribou*) in Alberta. *Canadian Journal of Zoology*, 92(12): 1029-1037.
- Holling, C., & Meffe, G. (1996). Command and Control and the Pathology of Natural Resource Management. *Conservation Biology*, 10, 328-337 pp.
- Huang, Y. (2015). *Potential Climate Change Impacts and Carbon Sequestration for Canfor Grande Prairie's FMA Area*. Grande Prairie: Canadian Forest Products Ltd.
- Kurz, W., Dymond, C., Stinson, G., Rampley, G., Neilson, E., Carroll, A., . . . Safranyik, L. (2008). Mountain Pine Beetle and Forest Carbon Feedback to Climate Change. *Nature*, 452, 987-990.
- Kurz, W., Dymond, C., White, T., Stinson, G., Shaw, C., Rampley, G., . . . Apps, M. (2009). CBM-CFS3: A Model of Carbon-Dynamics in Forestry and Land-use Change Implementing IPCC Standards. *Ecological Modelling*, 220, 480-504 pp.
- Lawrence, D., Lance, C., Willoughby, M., Hincz, C., & Stone, C. (2005). *Range Plant Community Types: Carrying Capacity for the Lower Foothills Subregion of Alberta (4th ed.)*. Edmonton: Sustainable Resource Development, Public Lands and Forests.
- Li, C., Flannigan, M., & Corns, I. (2000). Influence of Potential Climate Change on Forest Landscape Dynamics of West-Central Alberta. *Canadian Journal of Forest Research*, 30(12), pp. 1905-1912.
- Luo, Y. (2007). Terrestrial Carbon- Cycle Feedback to Climate Warming. *Annual Review of Ecology, Evolution, and Systematics*, 38, 683-712 pp.
- Mattson, D., Herrero, S., Wright, R., & Pease, C. (1996). Science and Management of Rocky Mountain Grizzly Bears. *Conservation Biology*, 10:1013-1025 pp.
- Mazur, K., James, P., & Frith, S. (1997). *The Ecology of the Barred Owl and its Role in Sustainable Forestry*. Prince Albert: Prince Albert Model Forest Association.
- McLellan, B. (1998). Maintaining Viability of Brown Bears along the Southern Fringe of Their Distribution. International Association for Bear Research. Ursus 607-611 pp.
- McLellan, B., & Hovey, F. (2001). Habitats Selected by Grizzly Bears in Multiple Use Landscape. *Journal of Wildlife Management*, 65:92-99 pp.
- McLellan, B., & Shackleton, D. (1988). Grizzly Bears and Resource-Extraction Industries: Effects of Roads on Behaviour, Habitat Use and Demography. *Journal of Applied Ecology*, 25:451-460.
- Meinke, A. (2014). *Bull Trout and Arctic Grayling Presence on Canfor's South FMA Area Map*. Grande Prairie: Alberta Environment and Sustainable Resource Development.
- Metsaranta, J., Kurz, W., Neilson, E., & Stinson, G. (2010). Implications of Future Disturbance Regimes on the Carbon Balance of Canada's Managed Forest (2010-2100). *Tellus B*, 62B, 719-728 pp.



- Moisey, D., Young, J., Lawrence, D., Stone, C., & Willoughby, M. (2012). *Guide to Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions in Alberta* (7th ed.). Edmonton: Alberta Environment and Sustainable Resource Development.
- Moore, M., Covington, W., & Fulé, P. (1999). Reference Conditions and Ecological Restoration: A Southwestern Ponderosa Pine Perspective. *Ecological Applications*, 9, 1266-1277 pp.
- Morgan, P., Aplet, G., Haufler, J., Humphries, H., Moore, M., & Wilson, D. (1994). Historical Range of Variability: A Useful Tool for Evaluating Ecosystem Change. *Journal of Sustainable Forestry*, 2, (1-2), 87-111 pp.
- Natural Resources Canada. (2007). *Is Canada's Forest a Carbon Sink or Source?* Ottawa: Natural Resources Canada, Canadian Forest Service.
- Nielsen, S., Boyce, M., & Stenhouse, G. (2004a). Grizzly bears and forestry I. Selection of clearcuts by grizzly bears in west-central Alberta, Canada. *Forest Ecology and Management*, 199:51-65.
- Nielsen, S., Boyce, M., Mace, R., Benn, B., Gibeau, M., & Jevons, S. (2004b). Modelling the spatial distribution of human-caused grizzly bear mortalities in the Central Rockies Ecosystem of Canada. *Biological Conservation*, 120:101-113.
- Nielsen, S., Stenhouse, G., & Boyce, M. (2006). A Habitat-based Framework for Grizzly Bear Conservation. *Biological Conservation*, 217-229.
- Nielsen, S., Stenhouse, G., & Boyce, M. (2006). A habitat-based framework for grizzly bear conservation in Alberta. *Biological Conservation*, 130:217-229.
- ORM. (2000). *Fire Return Intervals: Background Information for Canfor Grande Prairie Operations Sustainable Forest Management Plan*. Vancouver: Olympic Resource Management.
- Paddle Alberta. (2015). *Where to Paddle in Alberta (Alberta River Basins Map)*. Retrieved February 26, 2015, from Paddle Alberta: http://www.paddlealberta.org/paddling/paddling_database.asp
- Rex, J., Krauskopf, P., Maloney, D., & Tschaplinski, P. (2009). *Mountain Pine Beetle and Salvage Harvesting: Small Stream and Riparian Zone Response in the Sub-Boreal Spruce Zone*. Exten. Note 90. Victoria: B.C.Min.For.Range, For.Sci.Prog. .
- Ripley, T., Schimgeour, G., & Boyce, M. (2005). Bull Trout (*Salvelinus confluentus*) Occurrence and Abundance Influenced by Cumulative Industrial Developments in Canadian Boreal Forest Watershed. *Canadian Journal of Fisheries and Aquatic Sciences*, 62 (11), 2431-2442.
- Roever, C., Boyce, M., & Stenhouse, G. (2008). Grizzly bears and forestry II: Grizzly bear habitat selection and conflicts with road placement. *Forest Ecology and Management*, 256:1262-1269.

Royal Alberta Museum. (2006). *Eggs a Virtual Exhibition: Natural Regions Descriptions*. Retrieved March 6th, 2015, from Royal Alberta Museum: <http://www.royalalbertamuseum.ca/onlineExhibit/eggs/vexhome/regdesc.htm>

Running, S., Baldocchi, D., Turner, D., Gower, S., Bakwin, P., & Hibbard, K. (1999). A Global Terrestrial Monitoring Network Integrating Tower Fluxes, Flask Sampling, Ecosystem Modeling and EOS Satellite Data. *Remote Sensing of Environment*, 70, (1), 108-127 pp.

Russell, M. (2008). *Habitat Selection of Barred Owls Across Multiple Spatial Scales in a Boreal Agricultural Landscape in North-central Alberta*. Grande Prairie.

Schneider, R. (2013). *Alberta's Natural Subregions Under a Changing Climate: Past, Present, and Future*. Retrieved March 3, 2015, from Alberta Biodiversity Monitoring Institute: http://www.biodiversityandclimate.abmi.ca/docs/Schneider_2013_AlbertaNaturalSubregionsUnderaChangingClimate.pdf

Schneider, R., Stelfox, J., Boutin, S., & Wasel, S. (2003). Managing the cumulative impacts of land uses in the western Canadian sedimentary basin: a modeling approach. *Conservation Ecology*, 7:8 pp.

Seedre, M., Taylor, A., Brassard, B., Chen, H., & Jogiste, K. (2014). Recovery of Ecosystem Carbon Stocks in Young Boreal Forests: A Comparison of Harvesting and Wildfire Disturbance. *Ecosystems*, 17, 851-863 pp.

Smith, P. (2013). *Status of the Trumpeter Swan (Cygnus buccinator) in Alberta: Update 2013*. Edmonton: Government of Alberta and Alberta Conservation Association.

Solomon, S. Q., Chen, Z., Marquis, M., Avery, T., Tignor, M., & Miller, H. (2007). *Climate change 2007: The physical science basis; summary for policymakers, technical summary and frequently asked questions. Part of the Working Group I contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New Yourk, NY, USA: Cambridge University Press.

Soper, J. (1970). *The mammals of Jasper Park, Alberta*. Ottawa: Department of Indian Affairs and Northern Development.

Stewart, B., Nelson, T., Laberee, K., Nielsen, S., Wulder, M., & Stenhouse, G. (2013). Habitat Relations Quantifying Grizzly Bear Selection of Natural and Anthropogenic Edges. *Journal of Wildlife Management*, 77:957-964 pp.

Stinson, G., Kurz, W., Smith, C., Neilson, E., Dymond, C., Metsaranta, J., . . . Blain, D. (2011). An Inventory-based Analysis of Canada's Managed Forest Carbon Dynamics. *Global Change Biology*, 17 (6), 2227-2244.

Strong, W. (1992). *Ecoregions and Ecodistricts of Alberta*. Edmonton: Alberta Forestry, Lands and Wildlife, Land Information Services Division, Resource Information Branch.

- Strong, W., & Thompson, J. (1995). *Ecodistricts of Alberta: Summary of Biophysical Attributes*. Edmonton: Alberta Environmental Protection.
- Swift, G., & Cuzner, D. (2013). *Natural Disturbance Effects on Forest Carbon Dynamics, and the Role of Forest Management in the Process*. Retrieved April 26, 2015, from http://www.forrex.org/sites/default/files/forrex_series/FS28-Chapter-5-Forest-Carbon.pdf
- Tanner, D., & DeLong, C. (1996). *Managing the Pattern of Forest Harvest: Lessons from Wildfire*. . Prince George: Biodiversity and Conservation.
- Van Der Meer, P., Jorritsma, I., & Kramer, K. (2002). Assessing Climate Change Effects on Long-term Forest Development: Adjusting Growth, Phenology, and Seed Production in a Gap Model. *Forest Ecology and Management*, 162(1), pp. 39-52.
- Vroom, G., Hererro, S., & Ogilvie, R. (1977). The Ecology of Winter Den Sites of Grizzly Bears in Banff National Park, Alberta. *Bears: Their Biology and Management. International Association for Bear Research*, 321-330 pp.
- Wheatland County. (2013). *Alberta Invasive Plant Identification Guide*. Strathmore: Wheatland County.
- Wielgus, R., Vernier, P., & Schivatcheva, T. (2002). Grizzly bear use of open, closed, and restricted forestry roads. *Canadian Journal of Forest Research*, 32:1597-1606 pp.
- Wikipedia. (2014). *Sturgeon Lake Cree Nation*. Retrieved March 30, 2015, from Wikipedia the Free Encyclopedia: http://en.wikipedia.org/wiki/Sturgeon_Lake_Cree_Nation
- Wikipedia. (2015, March 20). *Lidar*. Retrieved March 24, 2015, from Wikipedia the Free Encyclopedia: <http://en.wikipedia.org/wiki/Lidar>
- Willoughby, M. (2007). *Range Plant Communities: Carrying Capacity for the Upper Foothills Subregion* (6th ed.). Edmonton: Alberta Sustainable Resource Development, Public Lands & Forest Division.
- Willoughby, M., & Alexander, M. (2006). *Range Plant Community Types and Carrying Capacity for the Subalpine and Alpine Subregions* (3rd ed.). Edmonton: Alberta Sustainable Resource Development, Public Lands Division.
- Wong, C. (2008). *Environmental Impacts of Mountain Pine Beetle in the Southern Interior*. Prince George: British Columbia Ministry of Environment Provincial Beetle Response Project Environmental Stewardship.
- Wong, C., & Iverson, K. (2004). *Range of Natural Variability: Applying the Concept to Forest Management in Central British Columbia*. Retrieved April 26, 2015, from <http://unfccc.int/bodies/awg-kp/items/5896.php>



Appendix A: Forest Management Agreement

Appendix B: Forest Management Plan

Terms of Reference

Appendix C: Public Involvement Plan for Canadian Forest Products Ltd. FMA #9900037

Appendix D: Canfor 2012 Forest Management Plan Growth and Yield Report

Appendix E: Annex: Canfor 2012 Forest Management Plan Growth and Yield Report

Appendix F: Canfor 2015 Forest Management Plan Landbase Assignment

Appendix G: Canfor Reforestation Strategy: 2015 Forest Management Plan

Appendix H: Canfor 2012 Sustainable Forest Management Plan

Appendix I: Canfor Grande Prairie FireSmart Management

Appendix J: Canfor 2015 Forest Management Plan Timber Supply Analysis Report
