Weyerhaeuser Company Ltd. Grande Prairie

FireSmart Management and Wildfire Threat Assessment

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Completed By:

**Alberta Sustainable Resource Development
Wildfire Management Branch**

Introduction

The aim of wildfire management is to balance the ecological role of fire while protecting human life, communities, watersheds and sensitive soils, natural resources, and infrastructure. The intention of the Alberta FireSmart program is to integrate fire, forest, and land management planning through a broad risk and resource management approach.

The goal of FireSmart forest management planning is to create a landscape in which catastrophic fire is minimized. This is accomplished through a combination of:
- Reducing the fire behaviour potential
- Reducing the fire occurrence risk
- Reducing the exposure of values at risk to fire
- Increasing the wildfire suppression capabilities

FireSmart landscapes are managed with the recognition of the interaction between the ecological, economic, and social impacts of fire while identifying opportunities for the use timber harvest and other disturbance strategies to meet landscape management objectives.

In order to meet FireSmart objectives, forest management activities in the Weyerhaeuser Company Ltd. Grande Prairie FMA will:
- Comply with provincial forest protection legislation, policy, and directives.
- Apply feasible FireSmart strategies within the FMA.
- Reduce the likelihood of large high-intensity, high-severity fires through the use of timber harvest targeting older age classes adjacent to values at risk.
- Ensure consultation with the public and stakeholders has occurred.

The Weyerhauser Company Ltd. Grande Prairie FMA

The Weyerhaeuser Grande Prairie Ltd. FMA covers seven Natural Subregions (NSR). These include the Central Mixedwood, Dry Mixedwood, Lower Foothills, Upper Foothills, Sub-Alpine, Alpine, and Montane Natural Subregions (Figure 1).

The combined Lower Foothills NSR and the Upper Foothills NSR cover approximately 70 percent of the FMA. The Central Mixedwood NSR and the Sub-Alpine NSR each occupy approximately 12 percent of the FMA. The Dry Mixedwood NSR occupies approximately four percent and the combined Montane NSR and Alpine NSR occupy nearly two percent of the FMA.

The two most common Canadian Forest Fire Behaviour Prediction (FBP) fuel types occurring in the FMA are C2 – Boreal Spruce and D1 – Aspen (Figure 2). There is also a large percentage of C3 - Mature Pine located throughout the FMA.

There are five FireSmart Community Zones which have portions occurring on the Weyerhaeuser Grande Prairie FMA. These zones include (Figure 2):
- Gundy - Saddle Oak FireSmart Community Zone
- Woking FireSmart Community Zone

- Grovedale - Aspen Grove FireSmart Community Zone
- Nose Creek FireSmart Community Zone
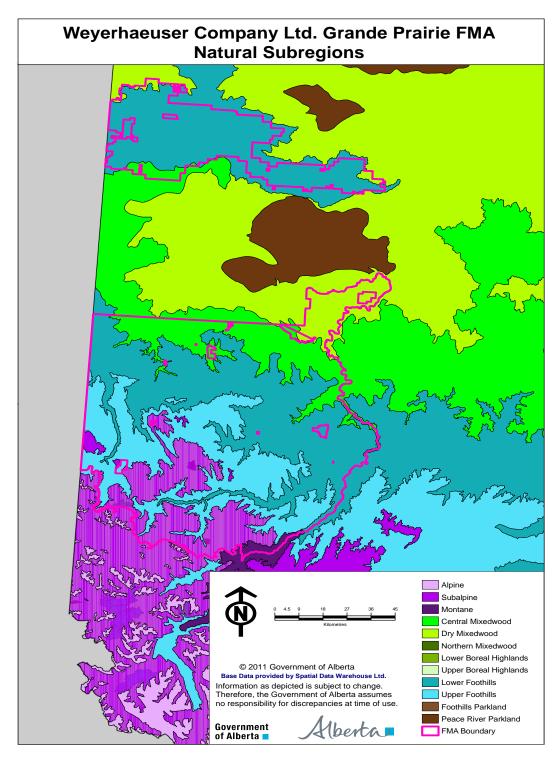- Wanyandie Flats East FireSmart Community Zone

Weyerhaeuser Company Ltd. Grande Prairie FMA Natural Subregions

Legend:
- Alpine
- Subalpine
- Montane
- Central Mixedwood
- Dry Mixedwood
- Northern Mixedwood
- Lower Boreal Highlands
- Upper Boreal Highlands
- Lower Foothills
- Upper Foothills
- Foothills Parkland
- Peace River Parkland
- FMA Boundary

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Figure 1. The Natural Subregions located in the Weyerhaeuser Company Ltd. Grande Prairie FMA.

Weyerhaeuser Company Ltd. Grande Prairie FMA
Fire Behaviour Prediction (FBP) Fuel Types

Blueberry

Gundy Saddle Oak

Woking

Grovedale Aspen Grove

Sturgeon Lake Clarkson Valley

Nose Creek

Wanyandie Flats East

Muskeg Seepee Settlement

Grande Cache

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C-1 (Spruce-lichen woodland)	S-1 (Jack or lodgepole pine slash)
C-2 (Boreal spruce)	S-2 (White spruce-balsam slash)
C-3 (Mature jack or lodgepole pine)	O-1 (Grass)
C-4 (Immature jack or lodgepole pine)	M-1/M-2 (Boreal mixedwood)
C-6 (Conifer plantation)	Non-Fuel
C-7 (Ponderosa pine-Douglas-fir)	Water
D-1/D-2 (Aspen)	Unclassified
	FMA Boundary
	FireSmart Community Zone

Figure 2. Canadian Forest Fire Behaviour Prediction (FBP) fuel types found on and adjacent to the FMA.

Fire Regime and Fire History

The following provides a general overview of the fire regime and fire history for the Weyerhaeuser Company Ltd. Grande Prairie FMA.

General Fire Regimes
The Weyerhaeuser Company Ltd. Grande Prairie FMA is located in the Lower Foothills NSR Upper Foothills NSR, Central Mixedwood NSR, Dry Mixedwood NSR, Montane NSR, Sub-Alpine NSR, and the Alpine NSR.

The Lower Foothills NSR occupies approximately 48 percent of the FMA. In this NSR, human-caused fires peak in May with lightning caused wildfires peaking later in the summer (Tymstra et al. 2005). Overall, the fire regime is considered to be one of frequent medium-sized fires (Tymstra et al. 2005).

The Upper Foothills NSR has a similar wildfire regime to the Lower Foothills NSR. The main difference is that the Upper Foothills NSR experiences more lightning caused wildfires (Tymstra et al. 2005). The peak fire season is from May to August in which frequent medium sized lightning caused wildfires occur (Tymstra et al. 2005). This NSR occupies approximately 22 percent of the FMA.

The Central Mixedwood Natural Subregion is characterized by white spruce and trembling aspen forest cover types. The wildfire regime in this NSR is predominantly frequent small fires and infrequent large fires (Tymstra et al. 2005). Human caused fire occurrence peaks in May as aspen and mixedwood stands typically do not reach green-up until the end of the month (Tymstra et al. 2005).

The central Mixedwood NSR occurs in approximately 12 percent of the Weyerhaeuser Company Ltd. Grande Prairie FMA.

The Dry Mixedwood NSR occupies approximately four percent of the FMA. Provincially, the area burned in this NSR is quite small due to prompt detection and suppression. This NSR is characterized by small and frequent human-caused fires (Tymstra et al. 2005).

The Montane NSR occupies a very small portion of the FMA. This NSR has a regime of frequent and small human-caused fires (Tymstra et al. 2005). Fire occurrence peaks in spring.

The Sub-Alpine Natural Subregion occupies approximately 12 percent of the FMA. This NSR is conifer dominated. The fire regime consists of infrequent small fires and very infrequent large wildfires (Tymstra et al. 2005).

The majority of wildfires in the Sub-Alpine NSR occur in summer with a peak area burned in August (Tymstra et al. 2005).

The Alpine NSR occupies an area of less than one percent of the FMA. The lack of fuels and rocky terrain in this NSR results in very few wildfires (Tymstra et al. 2005).

Fire Size and Historical Fires
Tymstra et al. (2005) reported the provincial average fire size as follows:
- Lower Foothills NSR = 77 hectares
- Upper Foothills NSR = 57 hectares
- Central Mixedwood NSR = 198 hectares
- Dry Mixedwood NSR = 36 hectares
- Montane NSR = 3 hectares
- Sub-Alpine NSR = 16 hectares
- Alpine NSR = not available

Historically, the 1930's, 1940's and the 1960's were the decades in which large fires occurred adjacent to and within the Weyerhaeuser Company Ltd. Grande Prairie FMA (Figure 3).

Fire Cycles
A number of studies with various methodologies have been used to determine the fire cycle in the Natural Subregions found in the Weyerhaeuser Company Ltd. Grande Prairie FMA. Fire cycles from the different studies provide ranges from 80 years to 300 years for the Sub-Alpine NSR and 45 years to 476 years for the Central Mixedwood NSR.

Roll back analysis tended to place the fire cycle for the Sub-Alpine NSR in the 80 year to 100 year range and in the 45 to 50 year range for the Central Mixedwood.

 The roll back method was used by Andison (2000) to determine the fire cycle in the Lower Foothills NSR and Upper Foothills NSR. The fire cycle was determined to be 52 years for the Lower Foothills NSR and 61 years for the Upper Foothills NSR. Provincially, Tymstra et al. (2005) used the wildfire size and frequency distribution method and determined the fire cycle to be 475 years for the Lower Foothills and 627 years for the Upper Foothills. The later method reflects a regime with human influenced wildfires.

The effect of fire suppression has resulted high estimates for the fire cycles in the Montane and Dry Mixedwood Natural Subregions. Both regions have fire cycles well over 1000 years due to human influence.

It should be noted that the fire cycle values were for studies completed in different areas of the province—the values are not specific to locations in the Weyerhaeuser Company Ltd. Grande Prairie FMA.

Recommendations – Fire Regime and Fire History

To best mimic historical fires and emulate natural disturbances, the following should be considered:

- Where possible, harvest disturbances should be located in Natural Subregions and forest fuel types (C1, C2, and C3) which are prone to burning and result in large historic fire sizes.
- To mimic wildfire and other natural disturbances, harvest design should take advantage of current disturbance based models.
- Opportunities for prescribed fire and disturbances other than commercial timber harvest should be explored on FMA lands.
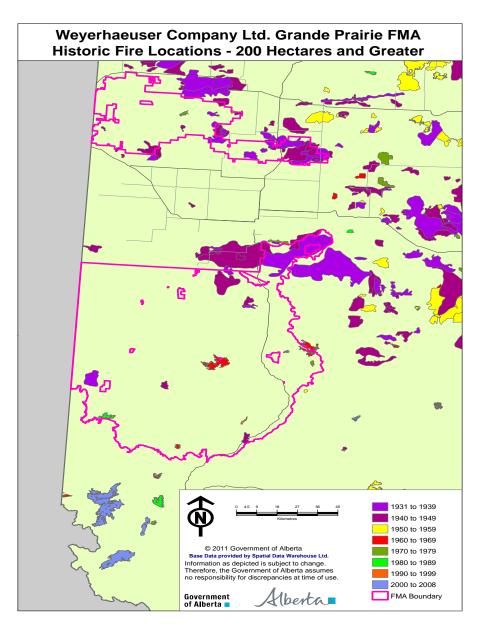

Figure 3. Historic fire locations in and adjacent to the Weyerhaeuser Grande Prairie FMA.

Wildfire Threat Assessment

The Wildfire Threat Assessment Model (WTA Model) allows an analysis of what influence the preferred forest management strategy will have in achieving wildland fire management objectives on both the current and future forest states in the FMA.

The WTA Model is a spatial model which is used to rate the susceptibility of an area to the negative impact of wildfires. The WTA Model is an ArcGIS application which combines several data layers into one layer representing the final wildfire threat rating. Each of the underlying layers is weighted according to pre-determined parameters (Figure 4).
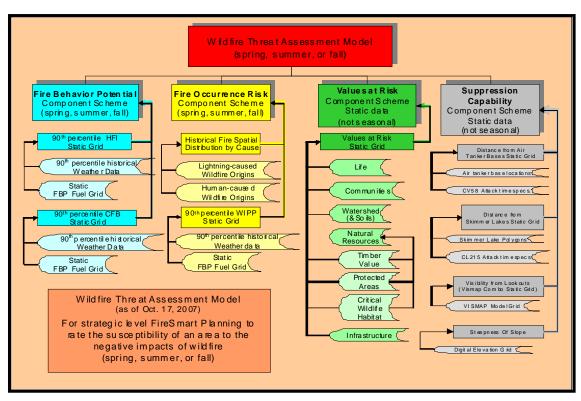

Figure 4. Wildfire threat model schematics.

The FireSmart objective for the preferred forest management strategy is to reduce the overall wildfire threat potential in the Weyerhaeuser Company Ltd. Grande Prairie FMA through:
- Reducing the fire behaviour potential
- Reducing the fire occurrence risk
- Reducing fire exposure to values at risk
- Enhancing wildfire suppression capability

Wildfire Threat Analysis –Fire Behaviour Potential
The wildfire threat analysis for the Weyerhaeuser Company Ltd. Grande Prairie FMA focused on the spring season as it is the season in which the greatest current fire behaviour potential occurs (Figure 5).

Assessment of what influence the preferred forest management strategy will have on the fire behaviour potential in the FMA required an analysis of how the spatial harvest sequence would contribute to a reduction in fire behaviour potential. The analysis indicated how much area of high, very high, and extreme rated forest structure will be removed from the landbase based on the spatial harvest sequence.

The current four-step process described in Annex 3 of the *Alberta Forest Management Planning Standard* was used to forecast the relationship between harvest sequence and fire behaviour potential.

The Wildfire Threat Assessment – Fire Behaviour Potential was completed for the Weyerhaeuser Grande Prairie FMA using the WTA Model. This output used forest fuel types, head fire intensity at the 90th percentile and crown fraction burn predictions as inputs. Fire behaviour potential was run for the current forest state. The model was then run incorporating the spatial harvest sequence to forecast fire behaviour potential at years 10, 20, and 50 (Figure 6, Table 1).

In order to effectively run the WTA model, the first four periods (20 years) of the spatial harvest sequence were analysed.

Fire Behaviour Potential – FMA Wide
The following analysis pertains to the entire FMA.

Weyerhaeuser Grande Prairie FMA - Base Fire Behaviour Potential

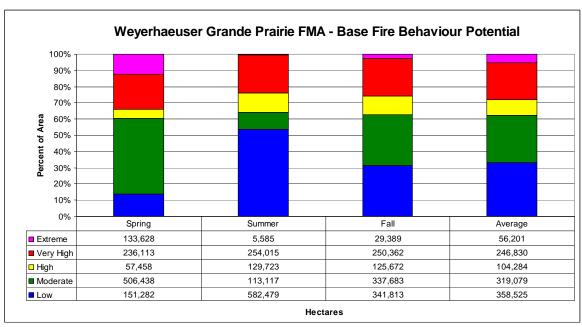|	Spring	Summer	Fall	Average
Extreme	133,628	5,585	29,389	56,201
Very High	236,113	254,015	250,362	246,830
High	57,458	129,723	125,672	104,284
Moderate	506,438	113,117	337,683	319,079
Low	151,282	582,479	341,813	358,525

Hectares

Figure 5. Seasonal fire behaviour potential for the FMA at the current forest state.

As previously mentioned, spring was the season with the greatest fire behaviour potential. It was the season used to model the fire behaviour potential and wildfire threat rating at years 10, 20, and 50.

The spring season is generally influenced by cured grass fuel types which are common in disturbed areas and leafless deciduous stands. This value is reduced when cured fuels green-up in the summer.
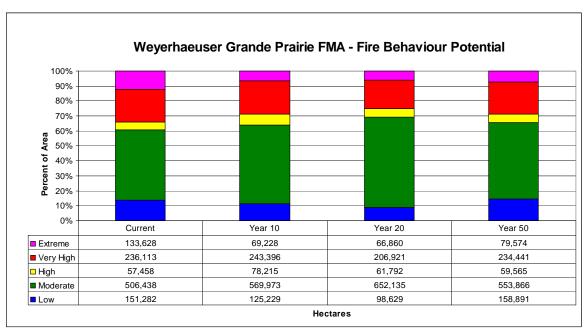

Figure 6. FMA fire behaviour potential at the different time slices.

The extreme fire behaviour potential was reduced by 64,400 hectares by year 10 through locating harvest disturbances in highly fire prone stands. This number decreased by another 2,368 hectares by year 20. As harvested areas matured, the value increased by year 50—however; there was a decrease in the extreme category over the entire 50 years by 54,054 hectares.

Table 1. Percent of the FMA in the different fire behaviour potential classes at each time slice.

FMA Fire Behaviour Potential Class	Current	Year 10	Year 20	Year 50
Low	13.3%	11.0%	8.7%	14.0%
Moderate	44.7%	50.3%	57.5%	48.8%
High	5.1%	6.9%	5.4%	5.3%
Very High	20.8%	21.5%	18.2%	20.7%
Extreme	11.8%	6.1%	5.9%	7.0%
Non-Fuel	4.3%	4.2%	4.2%	4.2%

The percent fire behaviour potential analysis at the different time slices showed a 3.2 percent decrease in the combined high, very high, and extreme categories from the current forest state to year 10. This was further reduced by another 5 percent at year 20.

The percent fire behaviour potential in the combined high, very high, and extreme categories was reduced by 4.7 percent from the current forest state by the end of the 50 year time slice.

Fire Behaviour Potential – FMA FireSmart Community Zones
The following analysis pertains to the FireSmart Community Zones located on the Weyerhaeuser Company Ltd. Grande Prairie FMA.

Weyerhaeuser Grande Prairie FMA
Fire Behaviour Potential - FireSmart Community Zones

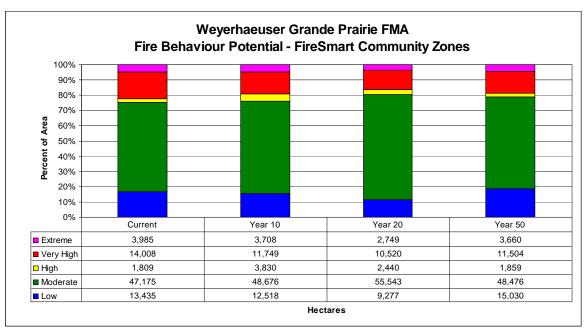|	Current	Year 10	Year 20	Year 50
Extreme	3,985	3,708	2,749	3,660
Very High	14,008	11,749	10,520	11,504
High	1,809	3,830	2,440	1,859
Moderate	47,175	48,676	55,543	48,476
Low	13,435	12,518	9,277	15,030

Hectares

Figure 7. FireSmart Community Zone fire behaviour potential at the different time slices.

The combined high, very high and extreme fire behaviour potential was reduced by 515 hectares by year 10. This number decreased by another 3,578 hectares by year 20. Overall, harvest disturbances identified in the SHS have reduced fire behaviour potential based in FireSmart Community Zones.

Table 2. Percent of the FMA Community Zones in the different wildfire threat rating classes at each time slice.

Community Zone Fire Behaviour Potential Class	Current	Year 10	Year 20	Year 50
Low	15.5%	14.5%	10.7%	17.4%
Moderate	54.5%	56.3%	64.2%	56.0%
High	2.1%	4.4%	2.8%	2.1%
Very High	16.2%	13.6%	12.2%	13.3%
Extreme	4.6%	4.3%	3.2%	4.2%
Non-Fuel	7.0%	7.0%	6.9%	6.9%

The Community Zone percent fire behaviour potential analysis at the different time slices showed a 0.6 percent decrease in the combined high, very high, and extreme categories from the current forest state to year 10. This was further reduced by another 4.1 percent at year 20.

The percent fire behaviour in the combined high, very high, and extreme categories was reduced by 3.3 percent from the current forest state by the end of the 50 year time slice.

When examining fire behaviour potential, it is important to look at where harvest disturbances are placed on the landscape. Disturbances should be located in strategic locations throughout the FMA to reduce problematic forest fuels, protect communities, increase the likelihood of fire containment and align with FireSmart and other landscape objectives.

Fire Occurrence Risk
Fire occurrence risk is based on the historical fire occurrence and wildfire ignition probability at the 90th percentile.

The fire occurrence risk for the Weyerhaeuser Company Ltd. Grande Prairie FMA is generally low to moderate throughout the spring, summer, and fall seasons (Figures 9, 10, and 11). Much of the area associated with moderate to high fire occurrence is near communities or locations frequently used for recreational activities. While fire occurrence has traditionally been low to moderate, the potential for large fires to occur in the FMA should not be overlooked.
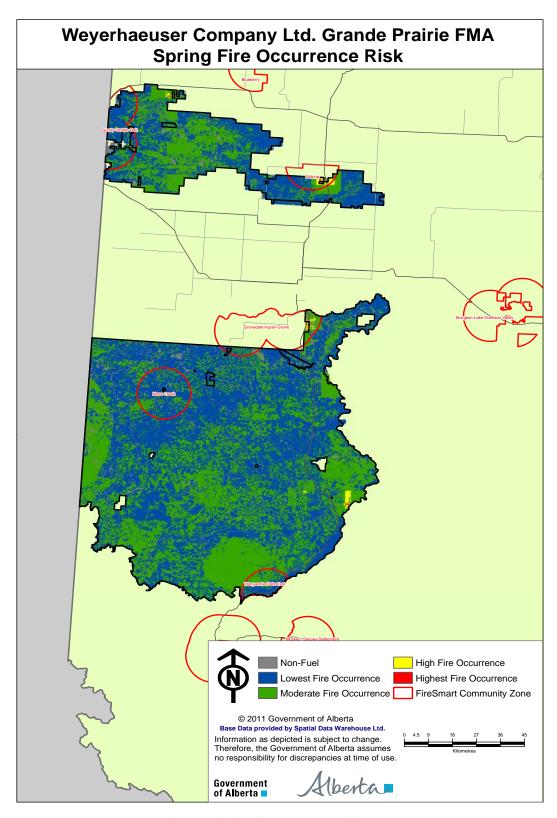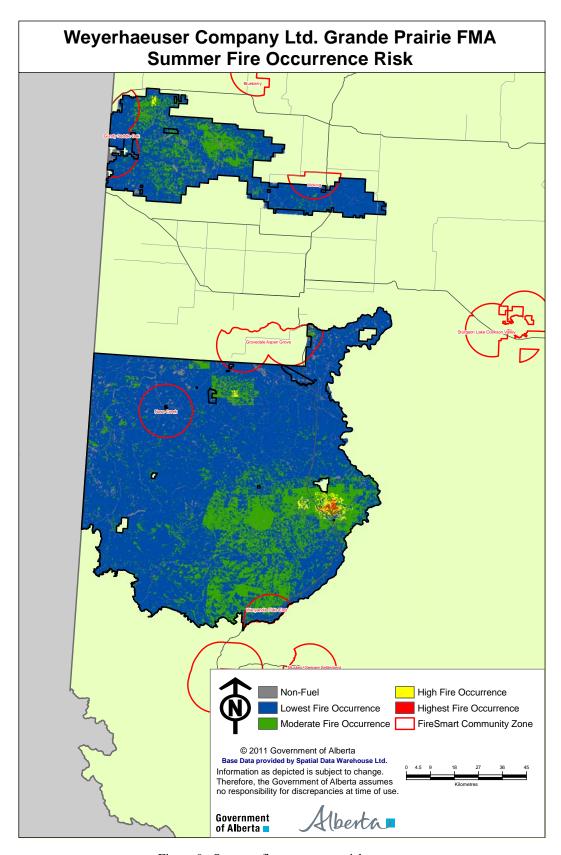
Weyerhaeuser Company Ltd. Grande Prairie FMA
Spring Fire Occurrence Risk

Figure 8. Spring fire occurrence risk.

Weyerhaeuser Company Ltd. Grande Prairie FMA Summer Fire Occurrence Risk

	Non-Fuel		High Fire Occurrence
	Lowest Fire Occurrence		Highest Fire Occurrence
	Moderate Fire Occurrence		FireSmart Community Zone

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Figure 9. Summer fire occurrence risk.

Weyerhaeuser Company Ltd. Grande Prairie FMA
Fall Fire Occurrence Risk

Legend:
- Non-Fuel
- Lowest Fire Occurrence
- Moderate Fire Occurrence
- High Fire Occurrence
- Highest Fire Occurrence
- FireSmart Community Zone

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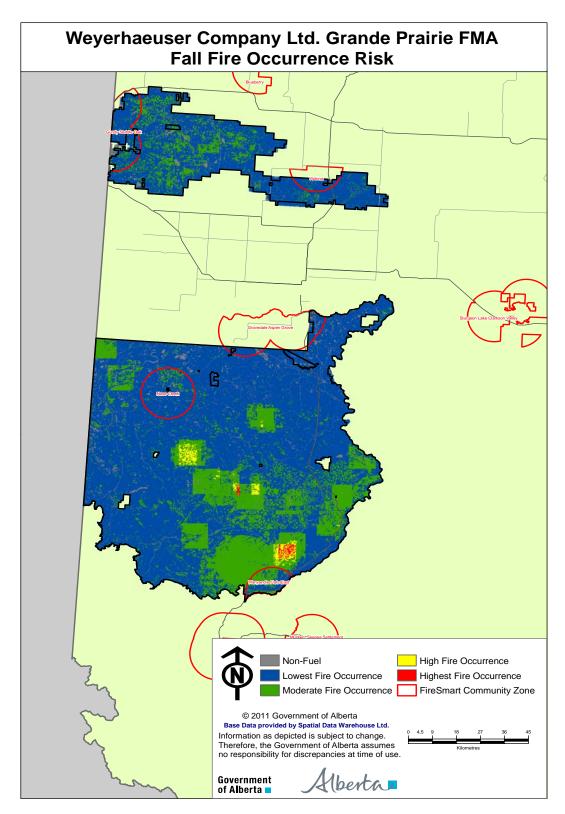Government of Alberta

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Figure 10. Fall fire occurrence risk.

Performance Standards

The following performance standard identified in Annex 4, Section 5.2 of the *Forest Management Planning Standard* shall be targeted through the implementation of the Weyerhaeuser Company Ltd. Grande Prairie Forest Management Plan.

Target	Reduce the area in the extreme and high fire behaviour potential rating by at least 6% across the FMA over the 20 year harvest sequence.
Target	Reduce the area in the extreme and high fire behaviour potential rating by at least 4% within the FireSmart Community Zone over the 20 year harvest sequence.
Means to Identify Target	Planning process, Wildfire Threat Assessment
Legal / Policy Requirements	Alberta Forest Management Planning Standard
Means of Achieving Objective and Target	• Spatial harvest sequence • Other FireSmart and disturbance strategies
Monitoring and Measurement	Annual Operating Plan
Reporting	Stewardship Report
Acceptable Variance	Issue specific
Response	Adjust the harvest sequence

Recommendations- Wildfire Threat Assessment and the Weyerhaeuser FMA
The following recommendations pertain to FireSmart management in the Weyerhaeuser Company Ltd. Grande Prairie FMA:
- The current SHS targets older age classes. It has resulted in a reduction in fire behaviour potential by removing problematic C2 (boreal spruce) and C3 (mature jack or lodgepole pine) fuel types. This meets the performance standard identified in the *Forest Management Planning Standard*. Any variance from the SHS should be examined to ensure at least a six percent reduction in fire behaviour potential is met across the FMA and a four percent reduction is met in FireSmart Community Zones.
- The potential to create a wildfire containment strategy on the FMA by aligning harvest and other disturbances should be explored.
- Merchantable stands located near settled areas, FireSmart Community Zones, and other values (recreation areas, other infrastructure) should be considered for harvest disturbances to reduce the exposure of these values to potential wildfire.

References

Andison, D. 2000. Landscape-level fire activity on foothills and mountain landscapes of Alberta. Alberta Foothills Disturbance Ecology Research Series, Report No. 2. Foothills Model Forest, Hinton, Alberta.

Tymstra, C., D. Wang, and M-P. Rogeau. 2005. Alberta wildfire regime analysis. Alberta Sustainable Resource Development, Forest Protection Division, Wildfire Policy and Business Planning Branch. Wildfire Science and Technology Report PFFC-01-05.