Fire plays a critical role in habitat renewal. Here, young seedlings regenerate the forest after a fire

Indicator 5.6.1
Occurrence and Severity of Wildfire

[1] Foothills Model Forest value
Natural processes.

[2] Objective
To maintain natural processes such as wildfire while minimizing the threat to societal values.

[3] Statement of indicator
Occurrence and severity of wildfire.

[4] Indicator measure
The measure for this indicator is the number of fires by class and by decade for the Foothills Model Forest landbase.

[5] Rationale for indicator

a. Significance of indicator to landscape-level management
Because of its ability to impact large areas of a landscape in a relatively short period of time, wildfire is a significant disturbance mechanism. Its evolving occurrence and severity through time impact many other indicators, such as stand age class, species composition and distribution, and water and soil qualities, and can even influence the contribution of forests to global ecological cycles.

b. Meaning of indicator
The occurrence and severity of wildfire directly impact the forested landscape. The quickest method of analyzing wildfire as an indicator is through size and frequency of occurrence. Even though size is not a perfect indicator of severity, we can assume that for wildfires of size class D or larger (see Table 1), the fire hazard for that specific area on the landscape is high enough to support the occurrence of large wildfires. The Canadian Forest Fire Danger Rating System (CFFDRS) is a science-based system that determines wildfire hazard on the landscape within Canadian forest cover types. This system can determine, document, and measure wildfire potential and severity; it bears out the use of size as a viable indicator for severity. It should be noted that most of the wildfires on the provincial landbase would also have undergone suppression efforts. This indicates that for class D or larger wildfires, fire danger was strong enough to have caused initial suppression efforts to fail. This supports the generalization that the larger the wildfire, the greater the severity.

Table 1 – Fire size classes

Class of fire	Size (ha)
Class B	0.11 – 4 hectares
Class C	4.1 – 40.0 hectares
Class D	40.1 – 200.0 hectares
Class E	200.1 hectares and greater

c. Relation of indicator to Foothills Model Forest and to sustainability

Wildfire on the landscape can be seen as having both positive and negative impacts on sustainability. As a natural disturbance process, wildfire is one of the most effective tools for renewing naturally forested landscapes. The challenge occurs when there are human-caused disturbances present on the landscape along with natural disturbance processes such as fire, insects, and disease. It could be argued that human-caused fires are also a significant cause of disturbance, and that the suppression of wildfire has an artificial impact on landscape disturbance. For all these reasons, and because it is related to the sustainability of the forest and to many forest values, wildfire must be managed to balance the impacts of disturbance on the landscape.

[6] Current status of indicator

Table 2 – Number of fires in the Foothills Model Forest, by class and decade

Lightning-caused				
Decade	**Class B**	**Class C**	**Class D**	**Class E**
1960s	22	2	1	2
1970s	15	2	1	2
1980s	34	3	5	2
1990s	21	1	0	0
2000s*	23	8	1	7

Human-caused				
Decade	**Class B**	**Class C**	**Class D**	**Class E**
1960s	30	1	2	0
1970s	53	5	25	0
1980s	57	13	2	4
1990s	45	11	5	2
2000s*	45	12	2	5

**Includes fires from 2000 to 2006.*

The 2006 Southesk wildfire was caused by lightning and was about 1500 hectares in size

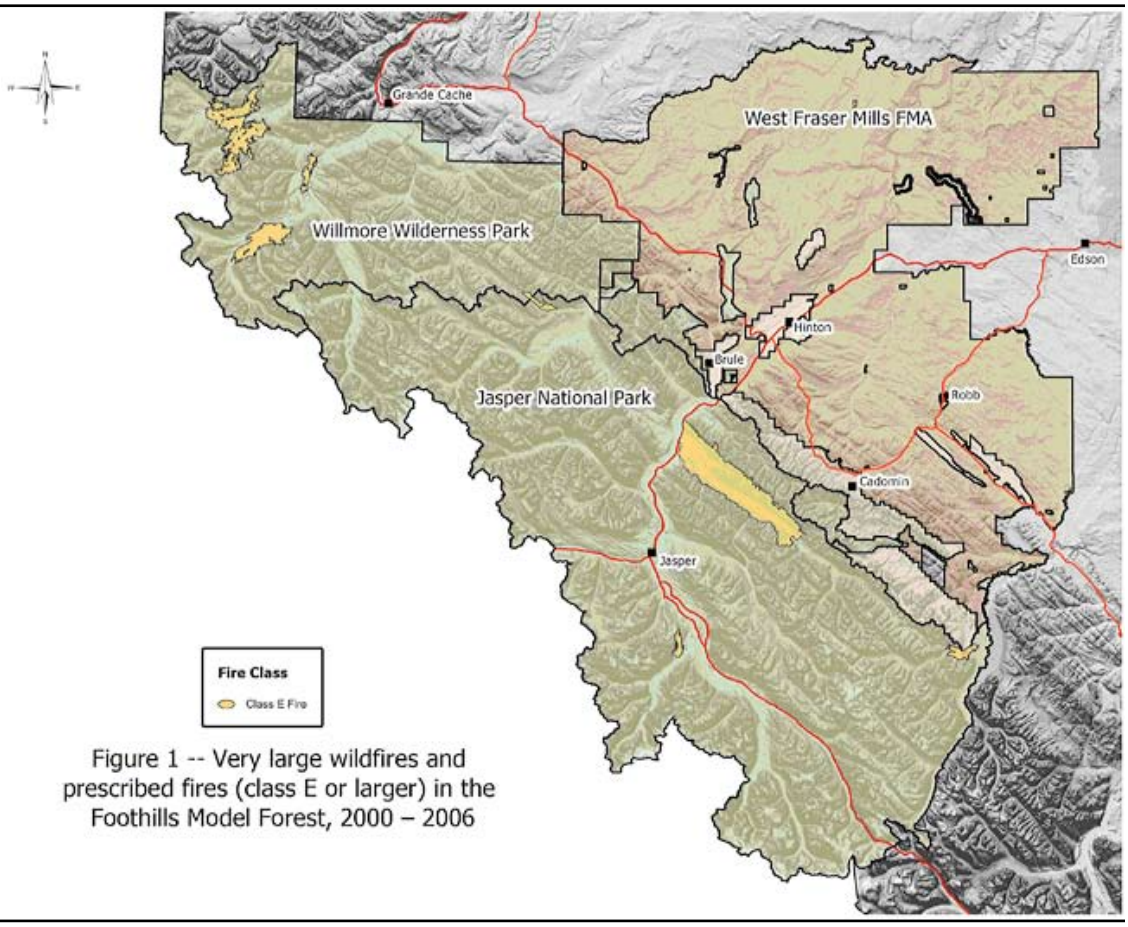

Figure 1 -- Very large wildfires and prescribed fires (class E or larger) in the Foothills Model Forest, 2000 – 2006

[7] Interpretation

There is historical wildfire data for Alberta, including Jasper National Park, dating back to 1931. However, for the Foothills Model Forest landbase, readily retrievable information for all fire sizes is only available back to 1961. These fires were classified by size and ignition source, but more in-depth detail and data is also available if needed.

For the purposes of this report, this information is enough to let us determine significant trends within the indicator. Early in the fire history of the area, railroad fires were the most frequent type of fires caused by people; however, overall there were more lightning-caused fires than human-caused fires.

However, with a growing population, increased vehicle access, the advent of all-terrain vehicles, and increased recreational and industrial activities, human-caused fires now well exceed lightning-caused fires in the Foothills Model Forest landbase. The number and area of fires caused by people versus lightning is an indication of the extent to which natural ecological processes may have been disrupted by humankind's influence.

Large wildfires can change local ecosystems, soils, and water, and impact many species, but the effects are not entirely negative. Disturbance at large and small scales can provide renewal and other opportunities for the ecosystem. The challenge is managing the impacts of fire together with other disturbances on the landscape so as to maintain and enhance ecosystem productivity.

Where there is little human-caused disturbance, wildfire can be a great tool to revitalize the forested landscape and provide a balanced mosaic within complex systems. Prescribed (planned) fire has and will continued to be used as a management tool in Jasper National Park and Willmore Wilderness Park to enable controlled disturbance without the challenges of a potentially out-of-control wildfire.

When fire occurs on the landscape as a prescribed fire, a concerted effort is undertaken to design the prescription with a low drought code (meaning that ignition in the deep compact organic layers in the floor of the forest is very unlikely). This ensures that the severity of the prescribed fire remains relatively low. Prescribed fire gives us an opportunity to renew the forest in a process that is more natural than traditional forest harvesting methods. Harvesting can also be limited in its ability to renew the forest, due to the need to focus primarily on the merchantable timber land base. In areas with multiple stakeholders and high land use, wildfire must be managed to protect values at risk and reduce its environmental, social, and economic impacts.

Fire size can work as a measure for severity, although it may not directly reflect the severity of each specific fire. At the landscape level, fire size can indicate the impacts that the fire may have. The determination of severity at a micro level is very challenging. In terms of severity, each fire can vary widely. Factors such as slope, aspect, fuel type, and time of day all influence the burn severity within each specific fire. This is why size is a suitable indicator for a fire's impact on ecosystem productivity and maintenance.

The most significant change in the last decade is the increase of large landscape class E fires (Figure 1). Many of these large fires have occurred in the upper foothills, sub-alpine, and alpine natural subregions. There have been naturally occurring wildfires and key prescribed fires within the last decade, but all the contributing factors to the wildfires have yet to be determined.

All that can be gathered at this time is that these fires occurred more frequently in the last decade (2000 – 2006), and coincide with some of the more significant fire seasons in Alberta. There are probably many reasons why there were more large wildfires during this period, but that discussion is beyond the scope of this document. The key point is that wildfire management has, and will continue to have, a critical role in the maintenance and enhancement of the condition and productivity forested ecosystems.

[8] Rationale for allowable variance (threshold)
There is no allowable variance for this indicator.

[9] Analytical considerations

a. Calculation of indicator
This indicator was calculated from numbers derived from spatial datasets for fires from both Alberta Sustainable Resource Development and Jasper National Park. Queries were generated to summarize the number of lightning- and human-caused fires for the last decade for fire size classes B to E for both datasets.

b. Special considerations
It should be noted that the fire data itself has limitations: the more historic the data is, the more potential there is for inaccuracies. Historical data can also contain less detail than we might wish to see today.

These limitations are why fire size and cause are used as a measure for this indicator -- this information is the most readily available over the longest historical time period. There may also be variations in how fires are measured. For example, through the history of recorded wildfires, random campfires in Alberta were not always consistently given a fire number; therefore, information on class A wildfires has been left out of this report (and the previous report), as the record is incomplete.

Whether to include prescribed fires in this indicator is another issue; currently, the assumption is that they should be included within the other fire data, but this could change in the future. As prescribed wildfire becomes more widely used within the Foothills Model Forest landbase, its significance may need to be demonstrated separately. Currently, the Jasper National Park prescribed fire program has been the most active in the last decade.

[10] Responsibility
Alberta Sustainable Resource Development and Jasper National Park are responsible for providing the data for this indicator.

[11] Monitoring
Alberta Sustainable Resource Development and Jasper National Park are responsible for monitoring this indicator. Because they're planned, prescribed fires always have a much more in-depth monitoring process. If a more complex analysis of this indicator is needed in the future, improved monitoring and documentation of both wildfire and prescribed fire will facilitate a more in-depth investigation.

[12] General discussion
Many of the general discussion points have been

covered in other sections of this indicator. One of the most significant issues is of that of the exclusion of class A wildfires – those that are less than 0.1 ha (less than 50 metres by 20 metres). Class A fires can also include abandoned campfires and single-tree lightning strikes. Class A fires are currently excluded from Table 2 because there hasn't been enough consistency in recording them, and the existing data may not properly reflect the changes over time.

Although this information is not included in Table 2, it's significant to note that there seems to have been a steady increase in human-caused fires over the years. Class A fires would reflect the largest differences in this area, possibly due to increased random camping and other recreational activities in forested areas. As human population increases, it stands to reason that there are growing pressures on the landscape for multiple uses, including recreation.

The last decade has seen 212 human-caused and 53 lightning-caused class A fires in the Foothills Model Forest landbase. A few years of current data have not yet been included, so the true numbers are probably much higher. Even though the class A fires (<0.1 ha) are very small and may not appear to be ecologically significant, their numbers do demonstrate the significant risk of fire disturbance in the Foothills Model Forest landbase. There has been a movement towards allowing more fire on the landscape, but with increasing pressures for multiple uses on the landscape, planners and land managers will be challenged to balance the need for disturbance with the needs of the other users of the forest.

The changing landscape has also seen an increase in threat from the mountain pine beetle. If the beetle (a significant long-term disturbance agent) is as successful in Alberta as it has been in British Columbia, there will be a significant increase in wildfire risk. Wildfires in beetle-infested stands of pine may result in more dramatic fire behaviour (depending on the stage of stand), and it's expected that as a result there will be more out-of-control fires.

Throughout the infested areas, there will be a large risk of wildfire risk: early reports from wildfires in BC's infected areas state that affected pine stands can show fire growth similar to that seen in boreal black spruce stands. The typical boreal black spruce stand is referenced in the Canadian Forest Fire Behaviour Prediction System as having a structure and composition that exhibit some of the most extreme fire behaviour and rates of spread that can occur in a standing timber type on flat terrain.

So in simple terms, in ideal conditions black spruce can exhibit extreme fire behavior and rates of spread. This means that for infested pine stands, we can expect faster rates of spread and higher fire intensities as compared to uninfested mature pine stands. Numerous ongoing studies on this topic are currently taking place; the results should soon shed more light on potential landscape impacts for the Foothills Model Forest landbase.

Noteworthy events for wildfire within the Foothills Model Forest landbase in the last decade include the following:

- Jasper National Park's signing off their Fire Management Plan
- Significant prescribed fires in Jasper National Park (Rock Creek and Syncline)
- The Willmore Wilderness Wildfire Management Plan (signed off in 2006)
- An increase in large class E landscape fires.

All of the above events have contributed to a healthy forested landbase that has maintained and enhanced long-term forest ecosystem productivity in the areas which they have taken place.

There has also been strong movement in the areas of community protection within the Foothills Model Forest landbase, as shown by the creation of community protection plans for areas in the landbase or those directly adjacent to it. Jasper, Grande Cache, Hinton (including the Yellowhead Corridor), and Robb now all have community protection plans developed in co-operation with the public, forest industry, local governments, and many other stakeholders.

FireSmart is a proactive fire prevention program that has been used in Alberta since the 1990s. Using FireSmart principles to reduce the wildfire threat and severity potential around communities has been a key success story in wildfire management for the Foothills Model Forest.

FireSmart techniques such as thinning, pruning, harvesting, and prescribed fire have all been used to enhance the forest ecosystems around the communities and to help protect people and their values at risk. Values at risk are human structures that are important to protect and save from wildfire, such as residences, settlements, historic buildings, campgrounds, cabins, and so on. FireSmart activities are ongoing within many projects; they all continue to help maintain and protect the forested areas in which people live and work.