A Guide to Managing Community Wildfire Risk




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Saskatchewan
Ministry of
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1. Introduction

The Guide to Managing Wildfire Risk is designed to assist community leaders manage wildfire risk within their jurisdiction. The primary tools available to proactively manage wildfire risk at the community level are discussed. Communities that manage their wildfire risks before a wildfire event have a much higher probability of reducing or even eliminating the impact of a fire when it does occur.

The manual provides the background information required to ensure that factors contributing to community wildfire risk are well understood. It also provides some key resources to help community leaders better manage their wildfire risk. The focus of the manual is on recognizing and managing wildland vegetation (fuels) that are responsible for creating wildfire risk. The manual goes into some detail on fuels management options and provides some examples of what other communities have done to manage their risk. A complete Community Wildfire Protection Plan outline is included, providing an overview of all the issues that should be addressed in order to manage wildfire risk within a community. Each community will have unique issues and challenges that should be addressed to manage their own wildfire risk.

Saskatchewan has over one hundred communities adjacent to or within the northern provincial forest. Many more individual homes and businesses are located within this same area. The boreal forest, which makes up our northern provincial forest, has evolved with wildfire and relies on the natural occurrence of fire to regenerate itself. Human caused wildfires add to the risk; most human caused fires occur within or in close proximity to communities.

Communities located in the parklands and grasslands also face a seasonal fire threat. During the spring and fall when the vegetation is dry, fast moving wildfires can pose a serious threat. As with many other jurisdictions, Saskatchewan has had it share of wildland urban interface (WUI) fires and close calls in recent years. This manual will assist individuals and community leaders to better understand the issues and options available to manage their wildfire risks.

Figure 1. 1999 Mallard Fire, La Ronge, Saskatchewan

2. Fire Environment

In order to manage wildfire risks, it is important to understand the basic principles of the fire environment. The fire environment may be described as the local site characteristics that have the most influence on fire behaviour. These characteristics include the fuels, weather and topography.

Fuel characteristics that influence fire behaviour include: the fuel continuity and arrangement, size and volume, and most importantly the moisture level. **Fuel continuity and arrangement** refers to the distribution of fuels over a given area. Distribution of fuel is an important factor in determining wildfire spread as fuels are required to spread fire over the landscape. **Fuel size and volume** impacts the intensity of a fire. Smaller fuels such as leaves, twigs and grasses are more readily available for combustion as they dry out quicker than larger fuels such as branches and logs. **Fuel moisture** affects the readiness for fuels to burn. Small amounts of precipitation will affect the ability of smaller fuels to ignite and burn. Fuel moisture is determined by: precipitation or relative humidity levels, the size of the fuels and the corresponding rates at which different sized fuels will dry or take on moisture and whether or not the vegetation is alive or dead.

Weather characteristics – **wind speed, wind direction and relative humidity** are the most critical weather elements to consider in the fire environment. These factors significantly affect the rate at which fuels dry out and the speed and direction a fire will travel once ignited.

Topographical characteristics – slope steepness affects fire in a similar manner as wind. Fires will burn uphill more rapidly than on level surfaces. The steeper the slope, the more impact it will have on the rate of spread of the fire. The aspect or direction the slope faces will also impact fire behavior; south and south westerly facing slopes tend to be much drier than northerly facing slopes. Although slope is not considered to be overly significant in Saskatchewan, even moderate slopes will result in a significant increase in fire behavour.

Fire behaviour is the manner in which fuel ignites and flames develop, fire spreads and exhibits other characteristics, such as **spotting,** and creating fire whirls. Fire behavior is determined by interaction among the infinite combinations of forest **fuels**, weather conditions, and topography. **Wildfire intensity** is the rate at which a fire is producing heat or thermal energy. **Fire severity** is the effect or impact caused to the vegetation, soils, and other values.

Of the three variables that form the fire behaviour triangle (Figure 2), only fuels can be modified to alter potential fire behaviour.

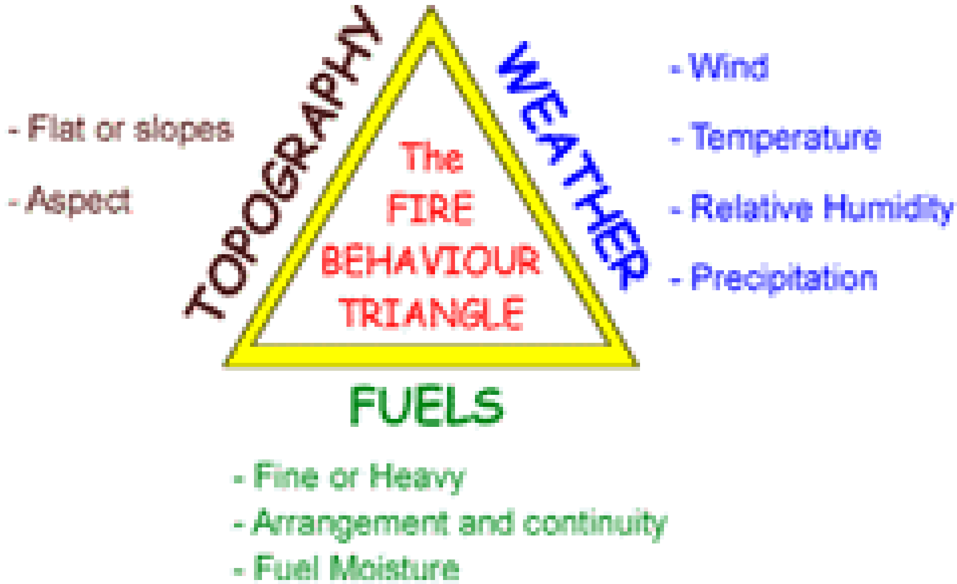

Figure 2. Fire behaviour triangle (Alberta Forest Protection website).

3. Assess Your Wildfire Risk

There are three ways in which structures can be ignited by a wildfire.

1. Burning embers or **firebrands** from a fire will descend in front of the advancing fire and start new fires. This is called spotting and a new single fire is called a spot fire. Spotting commonly occurs up to a kilometer in advance of the flame front. If these embers or firebrands, land in dry, receptive fuels they will create new fires. If they land in fuels adjacent to a structure or on a combustible part of a structure (e.g. shake roofing) then the structure is at risk to being consumed by wildfire.

2. A structure, or decks and fences attached to the structure, can come in **direct contact** with an advancing forest fire. Direct flame contact with the structure or any of the attached items may result in a structure ignition.

3. Structures may ignite because of the **radiant heat** produced by a fire. An intense fire burning 30 meters or less from a structure has the potential to ignite the structure.

3.1 Community Risk Assessment

Efforts to protect a community effectively from wildfire can only be realized once the risks associated with wildfires are understood. The Saskatchewan Community Wildfire Risk Assessment Project represents the first systematic assessment, and subsequent ranking, of communities at risk to wildfire in Saskatchewan. Communities were ranked as being low, moderate, high, very high or at extreme risk from wildfire. This was done by: examining the local fire environmental factors to determine potential fire behaviour, looking at historical wildfire ignitions and community fire preparedness capacity for each community. The assessment provides an excellent starting point for the development of a

Community Wildfire Protection Plan (CWPP). The community assessment report and links to all the community risk profiles can be accessed at: http://www.environment.gov.sk.ca/Default.aspx?DN=345cabaa-551e-437c-8122-292df6d38683

3.2 Measuring Risk Associated With Weather Conditions

Monitoring daily fire hazard level based on weather conditions can be done through the Fire Management and Forest Protection branch public website where this information can be accessed. The website address is: http://www.environment.gov.sk.ca/fire

This website provides links to the following information:

Current Wildfire Activity in Saskatchewan – includes a to-date fire map within the current fire season, an active fire ban map and a map showing all the active fires > 100 hectares (ha) in the province along with an international fire report.

Daily Fire Danger Maps – maps are provided for the agricultural, forest fringe and forested areas of the province that illustrate the ease of fire ignition and how quickly a fire will spread. Fire danger forecasts for the next day are also provided.

Fire Weather – weather forecasts for the current day, the next day and the following three days.

Environment Canada Weather Warnings – any warnings or watches will be posted.

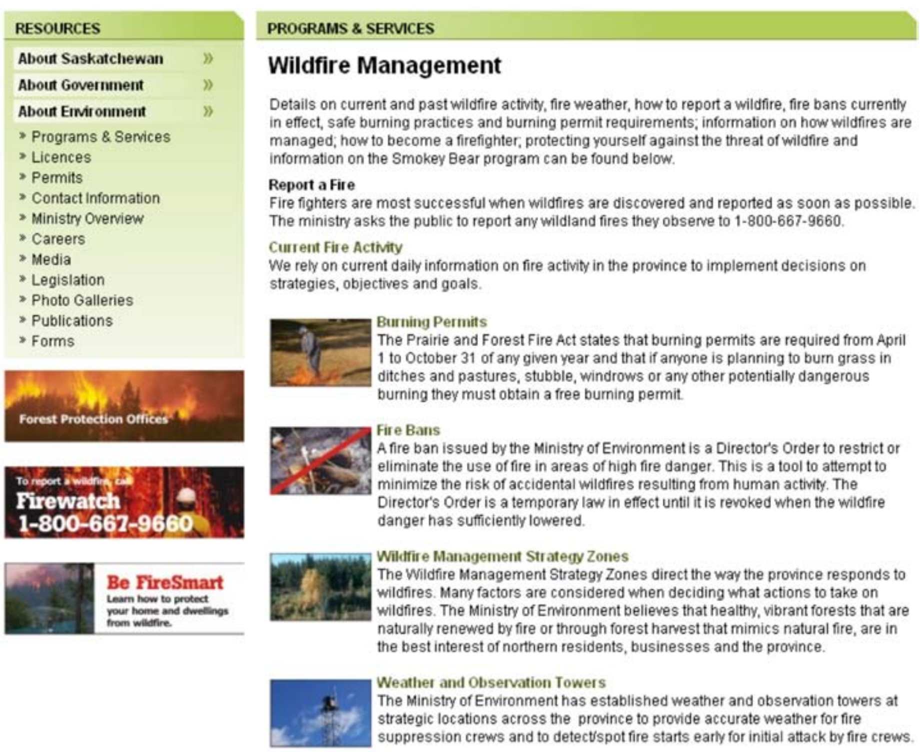

Figure 3. Fire Management and Forest Protection's public website.

4. Fuels Management

The term fuel or fuels management refers to changing the fuel structure in order to alter potential fire behaviour. The primary goal of fuel management is to reduce the amount of fuel available to a fire, thereby reducing certain fire behaviour aspects such as **fire intensity, fire severity,** and **rate of spread** of the fire (Parisien and Junor 2006). Fuel management work does not guarantee safety or that a wildfire will be stopped, but it will significantly increase the probability that a home or community will be less impacted by a wildfire when it does occur.

4.1 Fuel Layers and Descriptions

There are four basic fuel groups that are typical in a boreal forest environment. It is important to understand the importance and interrelationship each one has on the other in order to develop effective fuels management plans.

Ground fuels are the duff and roots lying below the current year's accumulation of fallen material and are generally highly compacted and partially decomposed. **Duff** is the partially decayed vegetative matter lying against the soils, the duff layer can be shallow or several metres deep (e.g., peat moss). Ground fuels typically burn by smoldering and may burn for many hours, days, or even years and are called **ground fires**. Ground fires are a potential ignition source for surface fires. It is important to recognize areas with deep ground fuels and to avoid burning brush piles or carrying out prescribed burns over them when conditions are dry.

Surface fuels consist of the dead leaves, needles, twigs, litter that has not yet begun to decompose, herbaceous fuels such as grasses and forbs, and dead and down woody material. **Surface fires** are best described as having flames that consume the surface fuels. They are the most common type of forest fire. Surface fires, especially when fine fuels are abundant, can be very fast moving wind-driven fires that can be dangerous and very difficult to control. **Most fires where tragedy and near-miss incidents occur are in fine, light fuels on smaller fires or on isolated sections of a larger fire (Alexander and Fogarty 2002, Wilson and Sorenson 1978).** For these reasons it is very important to manage surface fuels within any fuel break.

Ladder fuels (mid-level) are shrubs and trees either less than two metres in height or taller trees with branches and foliage within one metre of the ground surface. It is ladder fuels that often carry a fire burning along the surface into the crown canopy fuels, promoting crown fires and the torching of single trees or small clumps of trees (Graham et al. 2004). Ladder fuels must be treated within a fuels management area to prevent surface fires from reaching the tree crown layer where they become very difficult to control.

Crown fuels consist of the foliage, twigs, and smaller branches of the overstory vegetation. The live needles of coniferous trees are highly flammable because of their arrangement, which allows for free flow of air, and because they contain oils and resins susceptible to ignition. Crown fuel continuity and density in combination with wind and/or slope are required to produce **crown fires** (Graham et al, 2004). Crown fires usually occur when conditions are dry and windy. They are always intense, fast moving and dangerous. These fires may be so intense that they produce their own wind/microclimate and can produce spot fires kilometers ahead of the main fire. Crown fires cannot usually be attacked directly and are ultimately the worst fire type that fuel treatments are intended to prevent.

One of the primary objectives of a fuels management project is to thin or convert the forest vegetation to the point where a crown fire cannot sustain itself and will change to a lower intensity surface fire or where a high intensity surface fire is reduced to a moderate or low intensity fire. **Fuel/fire breaks** are either natural or man-made breaks in the continuity of the fuels and are meant to halt or severely restrict the spread of wildfire. **Fuel treatment /management areas** are aimed at reducing specific fire behaviour aspects, such as rate of spread, fire intensity, and fire severity. Fuel management/treatments and fire breaks are strategically located, based on wildfire assessments, to intercept wildfires before they get into (or out of) the community. Managing surface and ladder fuels within the break will ensure the fire looses intensity, allowing suppression personnel a better opportunity to stop or at least slow the fire down.

Fuel treatment/management areas create excellent locations to initiate suppression activities and can increase the effectiveness of several suppression tactics. Fuel breaks can be used for **burnout** operations, to improve the effectiveness of water bombers and helicopter bucketing operations, to increase access to water supply, to create safe **anchor points** for suppression efforts, and to reduce the risk of fire **spotting** (Parisien and Junor 2006) Whenever possible, fuel treatment/management areas should incorporate roads and trails to provide access and built-in fire breaks.

5. Fuels Management Options

"Appealing as the idea may be, there is no "one size fits all" solution. Given that fire behaviour and resulting severity result from the combination of weather, available fuels, and physical setting, the design of site-specific solutions will be highly variable" (Graham et al., 2004).

The option or combination of options that are chosen for community fuel breaks will be determined by the wildfire risk assessment and through discussions during the consultation process. The wildfire risk assessment should indicate: locations of high hazard fuels potential ignition sources, directions a fire is most likely to come from, time of year fire risk is the greatest, and what values require protection. The consultation process will identify local area use plans and concerns and will help shape the fuels management plan details. Fire management professionals are available to provide communities with technical advice to help in the development of fuels management plans. Based on all this information, the locations and specific fuel management treatments can be developed.

There are three fuels management options, including:

5.1. Fuel removal – eliminating available fuels; examples include prescribed burning, mowing or developing fireguards down to mineral soil (Figure 4).

Figure 4. Fireguard built along community edge.

5.2. Fuel reduction – reducing the amount of fuel that is available to a fire; examples include forest thinning and pruning (Figures 5 and 6).

Figure 5. A mechanical harvester preparing to thin a softwood stand, Jeanette Lake Fuel Management Project.

Figure 6. Mechanically thinned softwood stand, Jeanette Lake.

5.3. Fuels Conversion – changing the state of the available fuels so they are less volatile; an example is to remove the softwood trees from a mixedwood forest. Note the aspen regeneration showing up the next spring after a fuels conversion treatment (Figure 7).

Figure 7. Fuels conversion project, Waterhen Lake.

Common fuel management methods are provided in Table 1. Advantages and disadvantages of each option are provided to assist planners in the decision making process.

Table 1. Fuel Management Methods, Equipment Options, Objectives and Considerations. (Adapted from Johnson 2006b, Graham et al. 2004, Agee and Skinner 2005)

Method of Fuel Management	Equipment Used	Objective	Advantage	Comments
Thinning – Crown Fuels	Mechanical Logging – feller buncher	Reduce the amount and continuity of crown fuels available to fire	-Reduce the risk of a crown fire threatening a community -May compact, crush, or break up surface fuels during thinning	-Surface wind may increase -Surface fuels drier with open canopy -Amount of surface fuels either unchanged or increases
Thinning – Crown Fuels	Conventional Logging – hand feller	Reduce the amount and continuity of crown fuels available to fire	-Reduce the risk of a crown fire threatening a community -May compact, crush, or break up surface fuels during thinning	-Surface wind may increase -Surface fuels drier with open canopy - Slower than work done with feller buncher - Surface fuels usually increase
Thinning – Surface and Ladder Fuels	Mulcher (Mastication) and/or Hydro-axe	-Reduce surface and ladder fuels that can carry fire to the canopy - Increase the distance between forest floor and canopy	- Promotes easier fire control - Reduces chances of fire ignitions - Reduce torching and spotting potential - No slash	- Can increase probability of smoldering fires - Can reduce productivity of land - Compaction - Possible impacts on decomposition - Increase surface winds
Thinning – Surface and Ladder Fuels	Thinning by hand – chainsaws, brush saws, hand crews	-Reduce surface and ladder fuels that can carry fire to the canopy - Increase the distance between forest floor and canopy	- Promotes easier fire control - Reduces chances of fire ignitions - Reduce torching and spotting potential	- Labour intensive and time consuming - Slash issues -Increase surface winds
Fuel Conversion	Typically by logging	- Remove more volatile fuels (e.g. coniferous) - Promote the growth of less volatile fuels (e.g. deciduous)	- Produce lower intensity fires - Keep fires on surface - Increase chances of suppression	- Can produce intense fires in the spring - As stands become over mature or unhealthy fuel loading will increase
Prescribed Fire – Surface and Ladder Fuels	-Torches for burning -Foam generator, mower, or mulcher to create control lines	- Reduce fine fuels, duff, dead and down material, shrubs and other live surface fuels	- Reduces fuel continuity - Reduces spot fire probability and rate of spread - Reduces fine fuels and lower ladder fuels - Increases compactness of surface fuels	- Certain amount of risk -Not as precise a tool as thinning - Short burn windows restricted by weather and moisture conditions
Mowing – Surface Fuels (Fine fuels)	Mower	- Controls growth of fine, flashy fuels	- Reduces amount of fine fuels - Often used with prescribed fire - Can be cost effective	- Limited to where mower can go - Fine fuels form a mat on the surface that can lower productivity of the land

6. Fuel Break Planning Considerations

Fuel break planning considerations are provided to assist planners develop fuel management plans. Considerations covered in this section include: the width of fuel break required and treatment recommendations (given common boreal forest fuel types), treatment location, tying breaks into existing fire barriers, the shape of the treatment area and the importance of managing fine fuels. The information provided is based on field experience and observation and is provides benchmarks for consideration when developing fuel management plans.

Recommended Fuel Management Strategies for Common Fuel Types

In this manual, forest vegetation has been broken down into fuel types. The following is an overview of several common fuel types found in Saskatchewan's boreal forest.

Open Fuel Types (grass or grass/aspen mix):
For open fuels such as standing and matted grass fuel types, it is recommended that a fire break of 10 –15 metres (m) wide be made in areas where trees are absent and over 30 m where trees are present. These recommendations came from research carried out by Alexander and Fogarty in 2002 on Australian grass fuel types. The time of year is important in this fuel type as the cured fine fuels in the spring are replaced with new, fire resistant growth in the summer. Tools available to manage these fine fuels include: prescribed burning in the spring or fall, mowing, grazing with livestock, and/or keeping a fire break cultivated or scraped. Maintaining or developing fire breaks in the fall will ensure that a good fire resistant crop of green grass comes up first thing in the spring.

Boreal Mixedwood Fuel Types (conifer and hardwood mixed stands):
Fuel break width for boreal mixedwood stands is dependent on the percentage of conifer present in the forest stand and whether or not the hardwoods have greened up or not.

For stands comprised of 25 - 50 percent coniferous trees it is recommended that fuel breaks be constructed at least 100 m wide and up to 200 m wide where conifer content is higher. Forest understory and ladder fuels should be reduced by the removal of dead and down woody material and ladder fuels. Whole tree removal should be considered in larger patches of conifers.

For stands comprised of more than 50 percent coniferous trees it is recommended that fuel breaks be constructed at least 200 m wide and wider for stands with over 75 percent conifer. As the percentage of in-stand conifer increases, the amount of conifer that should be removed increases as does the width of the fuel break. If thinning is the preferred treatment, it is recommended that residual individual tree crowns be spaced at least three metres apart, or that patches of conifers be thinned between patches to a width equal to one tree length. This will prevent a burning tree from falling and igniting crowns in an adjacent conifer clump. When removing trees, it is important that the whole tree be removed from the treatment site. Trees should be limbed and topped at landing sites and all the slash should be disposed. Logging slash creates a highly volatile surface fuel if left on site. If a mulcher is used, all slash can be chipped and mulched on site.

Leafless Aspen Fuel Type:
Recommended width of a fuel management area for leafless aspen stands is 50 – 100 m, depending on the amount of fine fuels, surface fuels and dead and down woody material. Aspen stands are one of the least volatile fuel types. However, they are vulnerable to fire in the leafless stage of spring and fall. Managing for intensive surface fires is the main concern in this fuel type. If large amounts of fine fuel or dead and down woody material is present within a stand, it should be treated to prevent excessive fire behaviour. Managing these fuels can be accomplished by manually brushing out the fuels or by prescribed burning. Burning to remove surface fuels and promote aspen regeneration within the treatment area is a good option. Many aspen stands are often considered to be a natural fuel break and are incorporated into the overall fuel management plan.

Conifer Fuel Types (pine and spruce):
Conifer fuel types are often the most volatile fuel types and have the greatest potential of producing high intensity crown fires. It is recommended that fuel breaks be constructed a minimum of 200 m wide in these fuel types. Typically conifer stands are thinned to modify fire behaviour as a preferred fuel treatment method. When harvesting, it is important to limb and top the trees at the landing site to ensure volatile slash is removed from the treatment site. The exception is to mulch on site. Blowdown that occurs following the treatment can be a concern for several years once the canopy is exposed to the wind. To minimize blowdown, it is recommended to create smooth treatment edges. If patches of residual conifer are left, they should be egg-shaped with the pointed end of the patch facing the direction of the prevailing wind. These patches should have enough area thinned between them that a fire cannot easily travel from one patch to the next. This technique is now commonly used by the forestry industry when harvesting in conifer stands in an effort to emulate natural fire disturbance and to minimize blowdown.

Spruce – Lichen Woodland and Boreal Spruce Fuel Types:
The recommended width of a fuel management project in this fuel type is 100 m to over 200 m and is highly dependent on the density and size of black spruce present in the area of concern.

Lichen Woodland forest stands are often quite open areas with surface fuels dominated by reindeer lichen and branches of the black spruce that extend right to the ground. The more open a stand is, the less fuels management treatment is required. In open areas, the ladder fuels can be eliminated by removing shrubs and pruning branches up two metres. In areas where there is a higher density of black spruce, whole-tree removal may be required. This can be done by hand with brush and chain saws, mechanically logged, or mulched, depending on the size of the black spruce being removed.

Boreal spruce stands typically grow in low areas where there is a greater amount of moss and ladder fuels. Black spruce stands are often high density with branches extending to the ground. Both spruce fuel types easily produce crown fires because of the high volatile trees and abundant ladder fuels. Stands can be thinned by hand, mechanically logged, or mulched. Mechanical mulching of non-merchantable trees is recommended to efficiently remove these fuels. Burning slash or brush piles in these stands is **not** recommended because of the potential for ground fires.

Mature and Immature Jack and Lodgepole Pine Fuel Types:
Pine forests generally occur on drier, upland sites and are very volatile fuel types. Recommended width of fuel management projects in this fuel type is 200 m and over. The amount of material to be removed will depend on the density of pine and amount of ladder fuels. In mature stands, pine trees should be thinned leaving the tree crown spacing at three metres and the ladder fuels removed. If ladder fuels are the main concern in these fuel types, removal or thinning can be done by hand or with a mulcher.

Dead Balsam Fir/White Spruce Fuel Types:
In Saskatchewan, spruce budworm infestations have stressed or killed a large percentage of balsam fir and/or white spruce. These fuel types are very susceptible to wildfire. It is recommended to use the fuel break recommendations as indicated for the spruce fuel types for this type of fuel. Fuel break width consideration should begin at 200 m.

6.2 Location of Fuel Breaks

Fuel management areas must be properly located to be effective. If a fuel break is too far from a community, a fire can start between the community and the fuel break or a spot fire from an approaching fire may spread beyond control in this untreated fuel. If a fuel break slows down a surface fire or causes a crown fire to drop to the surface, it has done its job. However, this does not mean that the fire will necessarily be stopped. If there is untreated fuel inside of the fuel break, the fire may increase in intensity and still become a threat. If a fuel break is too close to a community, a fire can approach dangerously close before decreasing in intensity once it reaches the fuel break. Chances are greater that embers will fall into the community, raising the potential for structures to be ignited.

6.3 Tying Into Existing Fire Barriers

Existing fire barriers (road network, wet areas, green spaces, etc.) should be identified and utilized wherever possible when planning fuel management projects. Integrating existing barriers into fuels management planning will do the following:

- lower cost,
- increase fuel break effectiveness,
- cause less disturbance – more environmentally friendly,
- require less maintenance if combined with roads and trails, etc that are already present, and
- increase effectiveness of suppression forces by providing access and safety zones within or adjacent to the break.

6.4 Why the Shape of the Break is Important

It is best to try and keep fuel breaks as straight as possible. Breaks can have shallow curves in them but should not “S” back and forth. A relatively straight fuel break is shorter and therefore more easily defended. Numerous suppression tactics are more efficient when working on a straight line: it is easier to deploy sprinkler lines, it provides a good line for air tankers to drop retardant and foam on and it makes burning from the break itself safer. Corners typically result in areas where a fire is most likely to jump or breach the fuel break.

6.5 Why Fine (Surface) Fuels Management is so Important

Fine, surface fuels are easily ignited and can facilitate rapid rates of spread and sudden increases of intense “flare ups” of fires. Within a fuel management project area, it is **imperative** that the fine fuels be managed along with the larger surface fuels, ladder and aerial fuels. Logging slash should not be left in the treatment area and if there is a large amount of dead and down woody material, it should also be removed. The monitoring and maintenance of treated areas is also important, fine fuels (grasses) are usually the first to replace fuels removed in thinned forest stands   Depending on environmental conditions in the treatment site and prescribed treatment, grass may or may not have to be managed.

Figure 8. Crutwell Fire, Prince Albert, 2002. Figure 9. Mallard Fire, La Ronge, 1999.

6.6 Fuel Management Project Monitoring and Maintenance

Fuel management projects must be monitored, preferably on an annual basis, after completion. Forest vegetation will grow back and it is important that the treatment area is maintained in the following years for it to remain effective (Graham et al. 2004). During the planning and development stages of the fuel management proposal, a monitoring and maintenance schedule should be developed. The climate, soils, and other factors affecting the productivity of an area as well as the method of fuel management used will determine the duration that a project is effective (Keyes and O’Hara 2002).

Fuel management activities may lead to an accumulation of logging debris that can result in high hazard fuel being left on the site. Care must be taken to manage logging debris (tops and limbs) to ensure new fire hazards are not created. Fuel management activities may also increase the amount of grass growing on a site, resulting in an increased fire risk from these fine fuels. Opening up forest stands to carry out fuel management projects may result in some tree **blowdown**. It is important to note that some forest types are more susceptible to blowdown than others. While tree species like jack pine and aspen are relatively wind resistant, others like white or black spruce may be affected by opening up the tree stands to the wind. Project prescriptions should be developed with these points in mind and a regular monitoring and maintenance schedule should be developed to address any concerns that develop.

6.7 Community Acceptance of Fuel Management Projects

Fuel management plans that are developed should integrate the ecological, economic and social values of a community. The amount and/or type of fuel management planned for a community will depend on the level of investment by the community and its members, and the acceptability of the treatments, socially, ecologically, and economically (Graham et al. 2004). Fuel management plans for a community should be accepted and agreed upon by the community representatives, affected stakeholders, and the community in general.

7. Development of a Community Wildfire Protection Plan (CWPP)

Currently in Canada, the guiding principles for wildfire risk reduction, community protection and wildland urban interface (WUI) management is known as FireSmart. A guide entitled, “FireSmart: Protecting your community from wildfire” (Figure 10) is available**.** In the 1990s, an interdisciplinary group known as Partners in Protection developed a manual to provide practical tools and information to those living, working, and operating within the **wildland urban interface**. The FireSmart guide is intended to help communities recognize and reduce fire-related threats to existing developments, to prevent future hazards through better planning, to illustrate to community planners how to work together to reduce the risk from interface fires, and to increase the effectiveness of fire suppression response when necessary. This guide is an excellent resource to assist with the development of a CWPP. An electronic copy can be accessed at the website address: firesmartcanada.ca/about.

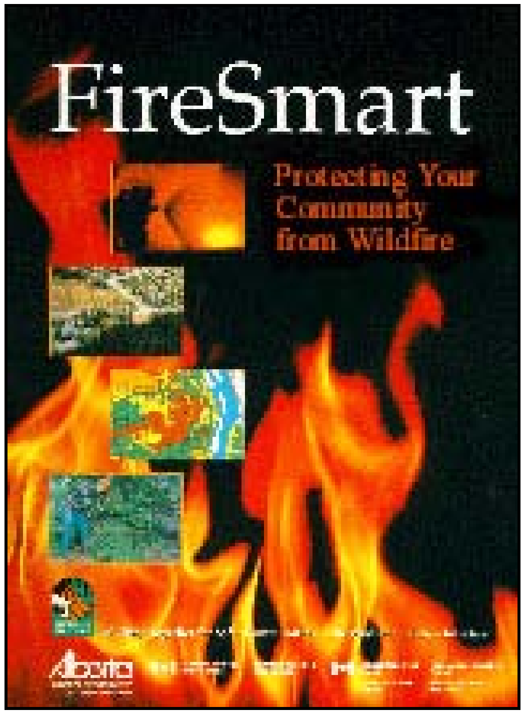

Figure 10. FireSmart: Protecting Your Community from Wildfire

7.1 Community Wildfire Protection Plan Outline

To properly prepare for a wildfire event a community must develop a protection plan that has input from all the stakeholders from each jurisdiction involved and must incorporate present and future land use plans within and adjacent to the community. Developing a plan is a cooperative effort designed to ensure coordinated and effective actions are carried out to mitigate the risk of wildfire.

Step 1: Identify Partners and Get Commitment

Fire protection is a shared responsibility requiring the involvement of community planners, public and government organizations and the residents themselves. Community Wildfire Protection Planning does not need to be a complex process. The key is to promote discussion among community members and stakeholders to determine priorities and develop plans for fire risk mitigation. Core planning teams typically include a member of community council, the local Emergency Measures Coordinator, a member from the local fire suppression force, key stakeholders and the local representative from the provincial forest fire agency.

Step 2: Identify the Communities Current Wildfire Risk Level

Through the Saskatchewan Forest Centre's Forest Development Fund, Fire Management and Forest Protection branch of Saskatchewan Environment and the Saskatchewan Forest Centre completed a course scale analysis of communities at risk from wildfire.

Three factors were assessed:

1. Surrounding vegetation and expected fire behaviour based on historical weather data.
2. Historical fire starts within and around the community.
3. Overall FireSmart assessment of the community itself (infrastructure, structures, preparedness level, suppression and detection capacity and size of the community).

A copy of the report outlining the details of the assessment process and copies of individual community assessment profiles can be accessed at: http://www.environment.gov.sk.ca/Default.aspx?DN=548bb226-240e-4bde-a71c-1461e72b78a6

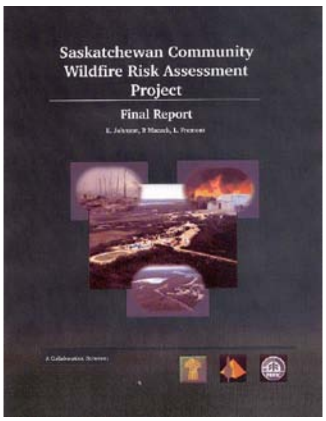

Figure 11. Final Report for the Saskatchewan Community Wildfire Risk Assessment Project

This assessment determined wildfire risk potential from the community boundary to a 20 kilometre radius from the community. Fire management professionals can assist to complete a wildfire risk assessment for your community if it was not included in the assessment process. **A risk assessment should be carried out within the community to determine the probability of future fires occurring and their consequences. Factors that should be assessed include**:

- Patterns: where, when and why fire can be expected to occur within the community,
- Probable direction of fire spread based on fire environment,
- Identify potential ignition sources within the community,
- Identify vegetation that will readily carry wildfire,
- Identify hazards to wildfire suppression activities (dangerous goods storage, towers, one way roads, narrow roads, etc.),
- Identify high risk structures, subdivisions or other values within the community,
- Identify fire suppression capacity within the community (personnel, equipment, training, fire agreements, etc.),
- Identify high priority structures or areas within the community (hospital, schools, etc.),
- Capacity of community infrastructure for fire suppression (municipal water supply in place, “green spaces” within community, road network, etc.),

- Identify preparedness level of community (emergency plan in place, key roles appointed, individuals trained etc.), and
- Identify public perception of wildfire risk.

Based on the wildfire risk assessments within and outside of the community, a series of actions can be identified and priorized to mitigate wildfire risks.

As part of the risk assessment, a map of the community and surrounding area should be developed. This map will provide a visual base to identify risks used to develop recommendations on protection and risk reduction priorities. The map will be very valuable for fire suppression planning. The map should identify:

- jurisdictional boundaries,
- area that the plan addresses,
- high risk vegetation areas,
- values at risk from wildfire,
- forest management activities,
- known ignition sources/historical fire locations,
- future land use plans within and adjacent to the community,
- escape routes and safety zones ,
- water supply areas,
- high risk structures,
- suppression hazards,
- natural and human made **fuel breaks** and **fireguards** within and adjacent to the community, and
- access routes.

Figure 12. Community Emergency Planning Meeting, Mallard Fire 1999.

Step 3: Define Roles and Responsibilities

Once a wildfire risk assessment is completed within and outside of the community, it is important to identify who has the authority and responsibility for each area where mitigation actions should occur. By having all the partners at the table with the overall wildfire risk assessment, an integrated effort can be developed to mitigate risk and build capacity within and outside of the community. Partnerships can be developed and actions can be scheduled effectively for everyone's benefit. Individuals are often assigned to represent and report back to a particular stakeholder group when developing the actual protection plans.

Each stakeholder must work within his or her legal mandate. This step will often identify barriers, conflicting regulations or policies that may have to be altered for overall public benefit.

Step 4: Set Goals and Objectives

There are seven FireSmart disciplines that should be used in conjunction with four guiding principles to establish CWPP goals and objectives. The four principles are listed below.

- Access to the area: prior to developing a prescription, ownership and land use have to be established to identify regulatory requirements,
- Operability of the land: identify factors, e.g. slope or muskeg that may limit proposed work,
- Cost: identify opportunities or partnerships to offset or limit costs, and
- Resources: identify internal resources available.

Using the fire risk assessment information and knowing the mandates and legal responsibilities of the stakeholders, a series of goals and objectives can be established. Risk abatement opportunities and capacity building recommendations can be prioritized as partnerships and resources allow. For each of the seven key disciplines identified for community wildfire mitigation, specific goals and objectives can be established. Invite a professional to recommend opportunities within each discipline. The disciplines include:

1. Education – Identify opportunities and options specific to the community for local citizens, businesses and industry.

Example: A community installs a fire hazard sign that reflects the daily fire hazard level to help make residents aware of the present fire danger.

Figure 13. Community Fire Hazard Sign, Candle Lake

2. **Fuels Management** – identify areas that will support high intensity or fast moving wildfire and develop specific goals and objectives to manage those areas.

Example: A community plans and initiates fuels management work around their subdivisions or garbage dump.

Figure 14. Pinehouse Community Wildfire Protection Plan Steering Group - identifying areas that would support a high intensity fire.

3. **Legislation** – identify opportunities where local legislation can be developed to manage fire use or fire risk within the community.

4. **Development** – guidelines can be established to ensure builders and developers follow FireSmart principles.

Example: Community planners can develop building codes and other FireSmart practices to ensure development recognizes and addresses local fire risks.

5. **Planning** – implementing restrictions or guidelines to meet community FireSmart objectives.

Example: Community planners can develop guidelines relating to green spaces, hydrant system and the road network, to ensure planning addresses fire risks.

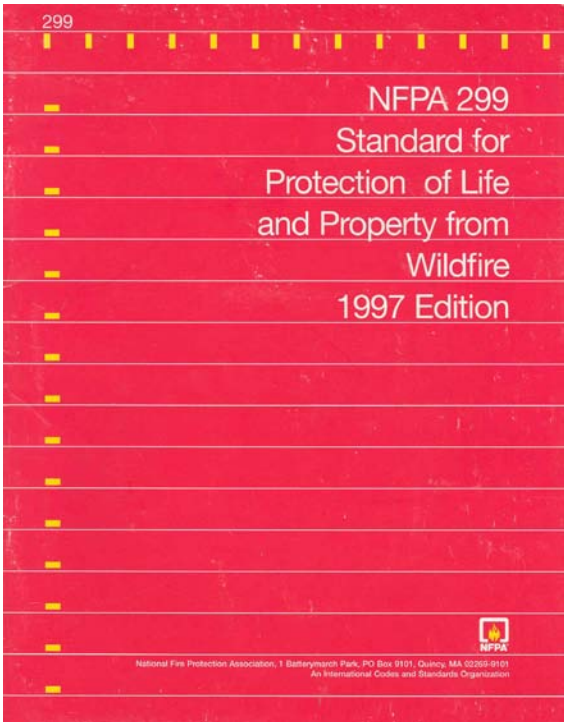

Figure 15. National Fire Protection Association Document – Standard for Protection of Life and Property from Wildfire

6. Training – in order to build capacity within the suppression and emergency management areas of the community, a variety of training options can be carried out.

Example: Community fire departments can be trained in wildfire suppression, safety and tactics.

7. Inter-agency Cooperation - numerous opportunities exist that will allow for interagency cooperation, including partnerships and agreements.

Example: Community can develop fire agreements with neighbouring jurisdictions to assist with suppression challenges.

Figure 16. Multiple Agency Response to a Wildfire in La Ronge.

Step 5: Document and Implement the Plan

Documentation should show the plan is an integrated effort that takes into account all stakeholder concerns, and considers the present and future land use plans for the community and for adjacent areas. Key stakeholders must be aware of the plan development and their issues should be addressed. If partnerships or agreements have been established, a legal review may be necessary. A copy of the plan should be kept by the community and by key partners.

It is recommended that a communications plan be developed in order to promote and educate stakeholders and community members as to the details of the CWPP. A formal community review process should be established.

Diligent supervision and support commitments are required when implementing the plan to ensure quality control.

Step 6: Monitor and Maintain

As time goes on, elements within the plan will change. Factors within any of the steps may change requiring adjustment to the plan. Annual review of the plan may be required to keep partnerships and agreements current and legal. Goals and objectives should be reviewed to ensure required actions are being carried out and to determine effectiveness of actions taken. A review and maintenance schedule is an essential part of the CWPP. Monitoring and maintenance will ensure current wildfire risks are identified and addressed over time.

Figure 17. James Fire, Turtle Lake, 2002 – 57 structures lost to a human caused wildfire. BE PROACTIVE – DON'T LET THIS HAPPEN TO YOUR COMMUNITY!!

8. Glossary

anchor points – a barrier to fire spread that will reduce the risk of fire burning around the control line and trapping firefighters.

blowdown – toppling of trees by wind.

burnout – a fire suppression operation where fire is set along the inside edge of a control line or a natural line or barrier to consume unburned fuel between the line and the fire perimeter, thereby reinforcing the existing line and speeding up the control effort (Saskatchewan Environment, 2003).

crown fires – fire that has ascended from the ground into the forest canopy (Wooten 2001, SKCNP).

crown fuels – live and dead foliage, live and dead branches, and lichen of trees and tall shrubs that lie above the surface fuels (Wooten 2001, Scott and Reinhardt, 2001).

fine fuels – fuels that ignite readily and are consumed rapidly by fire, e.g. cured grass (Saskatchewan Environment, 2005).

fireguards – a control line constructed either by hand or with heavy equipment that removes fuels down to the mineral soil and places them to the outside of the fire line so they are not available to burn.

fire intensity – also called Byram's intensity, is the rate of energy release per unit length of the fire front expressed as BTU per foot of fireline per second or as kilowatts per meter of fireline (Parisien et al., 2000). This is a physical parameter that is related to flame length. This expression is commonly used to describe the power of wildland fires, but it does not necessarily follow that the **severity**, defined as the vegetation mortality, will be correspondingly high (Carey and Schumann, 2003, Wooten 2001).

fuel – any material that is combustible and available to fire that can be consumed and promote the spread of fire.

fuel breaks – either natural or man-made breaks in the continuity of fuels that are meant to be used to halt or severely restrict the spread of wildfire. **Fuel treatments** are aimed at reducing specific fire behaviour aspects, such as rate of spread, fire intensity, and fire severity (Parisien and Junor 2006)

fuel compactness – how closely fuels are arranged and the spacing between particles. Loosely compacted fuels are freely exposed to air and burn more rapidly while compacted fuels, like log piles, burn slower because of the lack of space for oxygen (Saskatchewan Environment, 2005).

fuel continuity – a qualitative description of the distribution of fuel both horizontally and vertically. Continuous fuels readily support fire spread. The larger the fuel discontinuity, the greater the fire intensity required for fire spread (Parisien et al., 2000, Wooten 2001).

fuel moisture content – expressed as a percent or fraction of oven dry weight of fuel. It is the most important fuel property controlling flammability. Its daily fluctuations vary considerably by species but are usually above 80 to 100 percent. As plants mature, moisture content decreases. When herbaceous plants cure, their moisture content responds as dead fuel moisture content, which fluctuates according to changes in temperature, humidity, and precipitation (Paysen et al., 2000, Wooten 2001).

fuel volume – the amount of fuel (kg/cubic meter) available to fire for consumption.

ladder fuels – fuels, such as branches, shrubs or an understory layer of trees, which allow a fire to spread from the ground to the canopy (SKCMP, Wooten 2001).

radiant heat – the heat that is transferred from the heat source to the surrounding environment (i.e. the heat we feel from a campfire).

rate of spread – the speed at which a fire moves across the landscape measured in meters/minute.

spotting/spot fire – a fire producing fire brands (embers) carried by the wind, a fire whirl, and/or convection column that fall beyond the main fire perimeter and result in spot fires (Saskatchewan Environment, 2005).

surface fuels – needles, leaves, grass, forbs, dead and down branches and boles, stumps, shrubs, and short trees (Scott and Reinhardt, 2001, Wooten 2001).

wildland urban interface – any area where combustible wildland fuels are found adjacent to homes, farm structures, and other outbuildings. This may occur at the interface, where development and wildland fuels meet at a well-defined boundary, or in the intermix, where development and wildland fuels intermingle with no clearly defined boundary.

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Appendices

Appendix 1

Saskatchewan Examples of Fuel Management Projects

The following are examples of fuel management work that has been completed in Saskatchewan. To date, most fuel management work has been concentrated on crown/aerial fuels adjacent to communities and values at risk. The objectives have been to disrupt the continuous crown fuels adjacent to these communities by removing and reducing the amount of fuel in the canopy. The examples are as follows:

Example 1: Thinning and Conversion - Waterhen Lake Fuel Management Project
Example 2: Mechanical Thinning - Chitek Lake Fuel Management Project
Example 3: Prescribed Burn – Mistusinne Community Fuel Management Project

Example 5: Combination of Thinning Methods La Plonge Fuel Management Project
Example 5-A: Thinning - Ladder Fuels
Example 5-B: Thinning – Crown/Aerial Fuels
Example 5-C: Surface and Ladder Fuels – Mulching

<u>Fuel Management Example 1:</u> Thinning and Conversion
Waterhen Lake Fuel Management Project

Location and Size: The Waterhen Fuel Management Project is located along the north boundary of the Waterhen Lake First Nations Reserve within Meadow Lake Provincial Park. The project is 90 hectares (225 acres) in size, 300 meters wide and 3000 meters long.

Fuel/Stand Type: Project area contained a combination of mature white spruce stands and mixedwood stands. Stands were 20-25 m in height – all merchantable timber.

Purpose: The purpose of the project was to reduce the risk of a crown fire from reaching Waterhen First Nations from the north, through the Park, by removing mature white spruce and increasing the deciduous content (conversion).

Method of Fuel Management: Removed mature white spruce to reduce amount of aerial fuels that could support a crown fire. Thinned both softwood and mixedwood stands with 65 – 70% removal and left trembling aspen standing. A mechanical logging contractor (feller-buncher) was used to thin stands. Removing the white spruce opened up the canopy of the stand and promoted trembling aspen to re-generate, thus converting the stands to a hardwood dominate mixedwood stand.

Stakeholders involved: FMFP, Waterhen Lake First Nations, Meadow Lake Provincial Park, Forest Services Branch (FSB), Resource Stewardship Branch (RSB), Waterhen Forest Products, local trappers, Mistik Management Ltd.

Required Permits and Approvals: Forest Product Permit (FSB), approval from Highways Department (landings along road), and Park management (entire project on Park's land).

White spruce/trembling aspen stand in 2001.

White spruce removed. Aspen regeneration.

<u>Fuel Management Example 2:</u> Mechanical Thinning
Chitek Lake Fuel Management Project

Location and Size: Located around the north side of the Resort Village of Chitek Lake. Total size of project was 25 ha. Project was 100m wide.

Fuel/Stand Type: Project area contained small, dense jack pine and black spruce stands. Stands were 10 – 15 m in height.

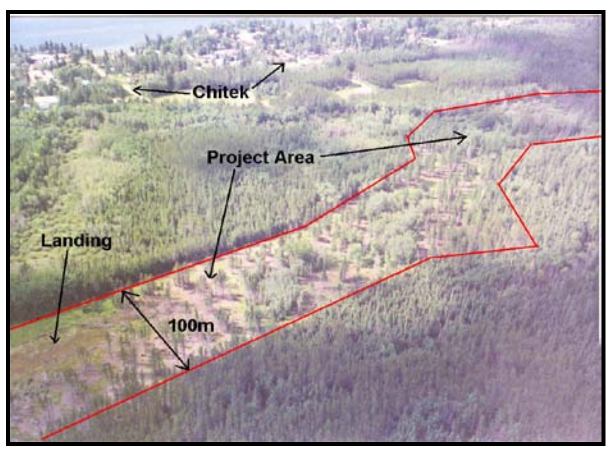
Purpose: The purpose of this project was to reduce the risk of a crown fire from reaching the community of Chitek Lake. This was accomplished by thinning the jack pine and black spruce stands adjacent to the community.

Method of Fuel Management: A wheeled feller-buncher and grapple skidder were used to remove both jack pine and black spruce fuels from the project area. Larger timber was used for firewood and smaller material was burned in slash piles. Approximately 70 % of the dense forest was thinned. Hand crews later treated the patches of forest that were not thinned mechanically. The hand crews removed the ladder fuels that remained within patches of standing fuels.

Stakeholders involved: FMFP, Resort Village of Chitek Lake, Chitek Lake Provincial Park, Forest Services Branch, Resource Stewardship Branch, Carlton Trail Railways.

Required Permits and Approvals: Approval from Resort Village of Chitek Lake, Railroad Crossing Approval from Carlton Trail Railways, a Forest Product Permit was not required since the project took place within municipal boundaries.

Aerial view of project before thinning.



Aerial view of project after thinning.

<u>Fuel Management Example 3:</u> Prescribed Burn - Grass
Mistusinne Community Fuel Management Project

Location and Size: The community of Mistusinne is located on the shore of Lake Diefenbaker between Douglas Provincial Park and the community of Elbow.
Total size of the project was 25 ha on crown land adjacent to the community.

Fuel Type: The vegetation within the project area consists of native and exotic grasses along with some patches of snowberry bushes.

Purpose: This project addressed wildfire risk for the community and also served to manage exotic plant species on the site. In the fall and spring of the year, before green up, grass fuels are an extremely volatile fire fuel. Grass fires ignite easily and can travel quickly during this time of the year.

Method of Fuel Management: A few weeks prior to the prescribed burn, a control line was mowed around the perimeter of the project area. The mow line and foam generators were used to safely allow suppression staff to burn a 20 m black line around the perimeter of the site. Once the burn line was in place, fire staff started stripping off 3 m wide strips of fuel on the downwind side of the project using a drip torch, continually increasing the width of the downwind black line. Crews continued to burn off fuels in this matter until the entire project area was completed.

Stakeholders Involved: Subdivision residents of Mistusinne, Douglas Provincial Park Managers, and Resource Stewardship Branch, local ranchers and members of the park advisory board

Required Permits and Approvals: Approval for the project was obtained from all the identified stakeholders of the project.

Creating a black line using foam generators and a green mowed line.

Stripping off the fuels with a hand torch

<u>Fuel Management Example 4:</u> Prescribed Burn – Aspen, Junction Prescribed Burn

Location and Size: The Junction Burn was located in the Meadow Lake Provincial Park. The size of the burn was 6.5 ha.

Fuel Type: The burn took place within a decadent (unhealthy) stand of trembling aspen. Fuels consisted of trembling aspen, dead and down trees, hazelnut shrubs, forbs and grasses.

Purpose: The main purpose of this prescribed burn was to promote aspen regeneration with fire and increase the health of the forest. The prescribed burn also removed fuels that had accumulated on the site and replaced it with new green growth.

Method of Fuel Management: The site had been chosen previous fire season as a test burn site. Roads and trails were used as control lines around the perimeter of the burn. The trails were mowed a week before the burn and hose lines and water sources were put in place the day before the burn. The perimeter was soaked down with water the morning of the burn. Narrow strips were burned off carefully to create a black line. Once a black line was created, wider strips were burned off until the entire plot was burned. Crews patrolled the burn after it was completed and for the next few days until it was determined to be completely out.

Stakeholders Involved: Fire Management & Forest Protection (FMFP) Branch, Meadow Lake Provincial Park Staff, Forest Services Branch, Resource Stewardship Branch, Greig Lake residents.

Required Permits and Approvals: Forest Product Permit since the burn was in the forest, approval from Park Manager, Formal Burn Plan and Proposal had to be approved by FMFP

Before prescribed burn.

Right after the burn.

3.5 months after the burn.

<u>Fuel Management Example 5:</u> Combination of Thinning Methods
La Plonge Fuel Management Project

Location and Size: The project consisted of two areas. The first area was located along the west side of the La Plonge subdivision and the second area was located along the road west of the subdivision to the La Plonge Campground. Total area of project was 20 ha, most of the project being within the La Plonge Recreation Site. The north end of the work done along the road was in Mistik Management's Forest Management Area. Width of project adjacent to subdivision was 200 m, the width along the road was 100 m.

Fuel/Stand Type: Project area was covered by small and dense jack pine and black spruce stands. Stands were 10 – 15 m in height.

Purpose: The purpose of this project was to reduce the risk of a crown fire from reaching the subdivision of La Plonge by thinning the jack pine and black spruce stands to break up the continuity of fuels adjacent to the community.

Method of Fuel Management: Three methods of thinning were combined and used on this project: 1) thinning of ladder fuels by hand (Example 5A); 2) thinning of aerial/crown fuels by a logging contractor (Example 5B); and 3) clean up work completed by a mulcher (Example 5C).

Stakeholders involved: FMFP, Resource Stewardship Branch (Recreation Site Superintendent), Forest Services Branch, Mistik Management Ltd.

Required Permits and Approvals: Approval from residents of La Plonge, Forest Product Permit for merchantable timber harvested, approval from Recreation Site Superintendent, agreement made with Mistik Management for removal of harvested timber and slash piles for chipping.

Aerial view of the community and project area.

Aerial view of work completed along the road to the campgrounds.

<u>Fuel Management Example 5A:</u> Thinning - Ladder Fuels
La Plonge Fuel Management Project

Location and Size: The project consisted of two areas. Thinning of the ladder fuels by hand (brushing) took place in the area of the project closest to the subdivision.

Fuel/Stand Type: Project area contained small, dense jack pine and black spruce stands. Stands were 10 – 15 m in height with dense ladder fuels leading up the aerial/crown fuels.

Purpose: The purpose of this project was to reduce the risk of a crown fire from reaching the subdivision of La Plonge by thinning the jack pine and black spruce stands to break up the continuity of fuels adjacent to the community.

Method of Fuel Management: Ladder fuels within the project area adjacent to the subdivision were thinned and piled by hand. The fire crews, Northern Works crews and First Nation crews did this work. The goal of this work was to thin or remove the fuels that could carry fire to the canopy. The piles were chipped and mulched during the clean up of the project.

Stakeholders involved: Refer to Example 5.

Required Permits and Approvals: Refer to Example 5.

Jack Pine and Black Spruce stand before thinning by hand.

Stand after the thinning was completed. Piles were chipped and mulched.

<u>Fuel Management Example 5B:</u> Thinning – Crown/Aerial Fuels
La Plonge Fuel Management Project

Location and Size: The project consisted of two areas. Thinning of the crown/aerial fuels was completed by a conventional logging contractor and took place in both areas of the project.

Fuel/Stand Type: Project area contained small, dense jack pine and black spruce stands. Stands were 10 – 15 m in height. Both merchantable and non-merchantable trees were removed by the contractor and piled along the road to the campground.

Purpose: The purpose of this project was to reduce the risk of a crown fire from reaching the subdivision of La Plonge by thinning the jack pine and black spruce stands to break up the continuity of fuels adjacent to the community.

Method of Fuel Management: Following the ladder fuel thinning, a conventional logging contractor thinned the larger merchantable and non-merchantable timber. Trees were cut with chainsaws and skidded out to roadside with line skidders. This worked well in the merchantable timber but is not recommended in small, non-merchantable timber. This work thinned the crown fuels and broke up the continuity of these fuels. Materials skidded to roadside was either hauled to a sawmill or chipped by Mistik Management and used for road stabilization. Remaining materials were left along the road to be burned at a later date.

Stakeholders involved: Refer to Example 5.

Required Permits and Approvals: Refer to Example 5.

Project area after logging contractor thinned the jack pine and black spruce.

Note the fuels left on the ground. Later cleaned up by crews and mulcher.

<u>Fuel Management Example 5C:</u> Surface and Ladder Fuels - Mulching
La Plonge Fuel Management Project

Location and Size: The project consisted of two areas. Clean up of the surface fuels and thinning of the ladder fuels with a mulcher (mastication) took place in the first area of the project adjacent to the subdivision.

Fuel/Stand Type: Project area contained small, dense jack pine and black spruce stands. Stands were 10 – 15 m in height with dense ladder fuels leading up the aerial/crown fuels.

Purpose: The purpose of this project was to reduce the risk of a crown fire from reaching the subdivision of La Plonge by thinning the jack pine and black spruce stands to break up the continuity of fuels adjacent to the community. After the logging was completed, there was a significant amount of fuels left on the surface that had to be cleaned up.

Method of Fuel Management: After thinning ladder fuels by hand, logging with a contractor, and clean up of surface fuels by hand crews, there were several piles of slash left that could not be burned. There were also areas where a significant amount of slash and ladder fuels remained. A mulcher was brought in to mulch remaining piles and to thin areas where ladder fuels remained. A mulcher chips and mulches larger woody material in to smaller chips and works it into the top layer of soil. The mulched areas were left level with the ground. Mulched areas will slow re-growth, retain moisture and decompose at an increased rate.

Stakeholders involved: Refer to Example 5.

Required Permits and Approvals: Refer to Example 5.

Mulcher at work on one of the piles of slash left after thinning work.

Mulched areas in the summer. Both piles and standing trees mulched.

For more information:

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