



Development permits: An emerging policy instrument for local governments to manage interface fire risk in a changing climate

By Paul Kovacs

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Table of contents

Executive summary	1
Introduction	2
Background	3
A brief history of wildland fire management	4
Prior to European settlement	4
European settlement	5
Toward a modern approach	5
Drivers increasing the risk of loss and damage	7
A growing population living at risk	7
Change in the climate	8
Elements of a comprehensive fire management strategy	9
Healthy forests and grassland ecosystems	9
Capacity to fight wildland fires	9
Resilient and empowered communities	10
The emerging role of Development Permits	11
Local government Development Permits	12
Regulating the design and construction of homes	12
Landscape regulations to keep fire out of the community	13
Prohibiting new residential development	13
Three communities taking action	15
Nelson, British Columbia	15
Swan Hills, Alberta	16
District of North Vancouver, British Columbia	17
Conclusions	18
References	20
Appendix I: Local building design and construction regulations	22
Appendix II: Local building siting and landscape regulations	29

Executive summary

Development permits are planning tools that local governments can use to manage development, protect the environment and address local health and safety issues. The system can be used to combine management of zoning, site planning and minor variants into a single process. More than a dozen communities in British Columbia and Alberta have begun to use development permits to control the extent, nature and location of new residential development in the wildland-urban interface, establishing an emerging policy instrument for local governments to address the risk of loss from wildland fire and ensure that communities are safe places to live, work and play.

Several local governments now include covenants in the development permit system requiring fire resilient building materials for new homes. Conditions for approving a development permit may include fire-retardant roofing, exterior walls sheathed with fire-resistive materials, windows with tempered or double-glazed glass, decks built with fire-resistant materials, screens on all eaves, attics and roof vents and chimney spark arrestors. The provincial and territorial governments do not presently include provisions addressing the risk of damage from wildland fires through their building codes; fortunately, these public safety measures are now emerging in local government development permit requirements.

The development permit system can also address landscaping and site considerations to reduce the risk that wildland fire will enter and spread through a community. This may include a requirement for defensible space of at least 10 metres around each home free of combustible materials, thinned plantings and reduced combustibles in a zone extending at least 30 metres around each home, underground servicing for hydro, considerations to address the additional risk to structures on a slope, fire breaks and other community safety measures. The overall objective is to ensure that new residential developments are designed with measures to defend against the risk of wildland fire blowing or burning into the community.

Most significantly, development permits provide local governments with the authority to control and even prohibit residential development in zones of high fire risk. There has been rapid growth in the number of people that live in or near the wildlands across Canada. This includes more permanent residences and seasonal homes. Evidence from the United States, Australia and emerging in Canada shows that growth in the number of people living in areas at risk is a critical factor that has been increasing loss and damage in the wildland-urban interface. Development permits give local governments the authority and responsibility to control residential development in interface zones with high risk of fire.

Land use planning is a tool that local governments around the world use to reduce the risk of flood damage. In Canada, several communities have begun to use planning tools, like development permits, within a comprehensive community wildland fire management strategy. The growing population living in the interface and projections of an increasing area burned by wildfire due to climate change suggests that these tools are likely to spread in the years ahead to be used by local governments across the country. Local planning decisions can provide an important contribution within a comprehensive community wildland-urban interface fire management strategy.

Introduction

Fire is an essential agent for ecological renewal and health in Canada's forests and grasslands. However, fire also has the potential to destroy homes, disrupt communities and threaten the health and safety of Canadians. Loss and damage from fire in the wildland-urban interface has been growing and is expected to increase significantly over the coming decades unless current practices adapt. In particular, the rising number of people that live in the interface and the impact of climate change to increase the expected area burned are two factors that will drive fire losses higher unless action is taken.

For almost one hundred years, fire specialists have managed the risk of loss and damage from wildfire in Canada with little involvement from individual property owners and communities located in or near the wildlands. Most fires were identified soon after they began and suppressed quickly. For many decades, there were few wildfire fatalities and relatively little damage to property.

Since the 1990s, however, there has been a trend of rising costs of fighting wildland fire and fire damage. These costs have been growing in Canada and have increased at an unsustainable rate in some other countries, like the United States and Australia. The most damaging wildfires in Canadian history, in terms of the value of property destroyed, were relatively recent events in 2003 and 2011.¹ There is widespread agreement that the current approach to fire management needs to evolve (Canadian Council of Forest Ministers 2005; Hirsch and Fuglem 2006).

Emerging fire management best practices are complex and seek to involve many stakeholders. Fire specialists continue to address fires when they ignite. There are also efforts to reduce the risk of large, uncontrolled fire through prescribed burning, thinning of forests and creation of fire breaks. Beyond the forests, efforts are underway to involve property owners in managing the risk of fire damage. National programs like FireSmart seek to educate property owners and community leaders about the role of fire in the ecosystem and actions Canadians can take to reduce the risk that fire enters a community.

New wildfire management tools are frequently identified and tested in this changing environment. Of interest in this report is the emerging role of local government planning officials. Over many decades, planners have provided important tools to address other hazards, like the risk of loss from flooding. Some progressive communities have begun using established tools, like development permits, to address the risk of damage from wildfire.

The development permit system is a planning tool that local governments can use to manage development, protect the environment and address health and safety issues. The system can be used to combine management of zoning, site planning and minor variants into a single process. Some communities have begun to use development permits to control the extent, nature and location of new residential development in the wildland-urban interface, establishing a new policy instrument to address the risk of loss from wildland fire and ensure that our communities are safe places to live, work and play. These tools may spread in the years ahead to be used by local governments across the country, recognizing the important contribution that local planning decisions can make within a comprehensive wildland-urban interface fire management strategy.

¹ This report was written and published as a case study in *Economic instruments for adaptation to climate change in forestry* (October 2014) prior to the devastating wildfire in Fort McMurray, Alberta in May 2016. That event destroyed approximately 2,400 structures (most of them single family homes), leading to approximately 49,000 insurance claims and \$3.57 billion insured and \$6 billion in total damage.

Background

More than 93 percent of Canada's 402 million hectares of forests are located on public lands, so wildfire management has traditionally been viewed as the responsibility of the provincial, territorial and federal governments (*Canadian Wildland Fire Strategy Vision 2005*). Other stakeholders, like forestry companies, are aware of the importance of fire for their business operations. Communities located in the wildlands may have experienced multiple evacuation orders due to wildfire and are aware of the risks to health and property. Nevertheless, it is widely held that that the provincial, territorial and federal governments have lead responsibility for wildland fire management in Canada.

Provincial and territorial governments also have legislation in place that sets out the powers and authorities of local governments to address community issues. In British Columbia, this is the Local Governments Act; in Alberta, it is the Municipal Governments Act. The Government of Canada has legislation in place setting out the powers and authorities for a specified group of First Nations to manage their lands through the First Nations Land Management Act. The purpose of the provincial, territorial and federal legislation is to provide the legal framework for local action by establishing the powers, duties and functions necessary for local decision makers to respond to the needs of their communities.

Some of the functions assigned to local governments include policing and public safety, planning and land use management, enforcement of building regulations, urban fire protection, public health, storm and waste water management, waste and recycling management, heritage conservation and animal control (Tindall et al 2012). There is some variation across the country in the specific policy areas assigned to local governments. There is also variation in the role for local and regional governments. Nevertheless, the specific functions and authority of local governments are determined by the provincial and territorial governments and have considerable similarity across the country. In particular, land use development and community planning is a function provided by local governments across the country. The development permit system is one dimension of the planning authority assigned to local governments.

Building codes and the regulation of construction is also an essential element of managing the risk of loss and damage as a result of hazards. The provincial and territorial governments have primary responsibility for regulating construction practices in Canada, but aspects are shared with the federal and local governments. The Government of Canada produces a model building code in partnership with the provincial and territorial governments. The model code applies to federal lands and is a guide that provincial and territorial governments use to create their building code legislation. The provincial and territorial governments, in turn, assign responsibility for enforcing compliance with the codes to local and regional governments. The City of Vancouver has authority to manage a building code for the city. Other local governments across Canada can use land use planning powers to introduce requirements for their communities to address environmental or health and safety issues.

Partners in Protection and NFPA Canada made a joint submission requesting that the Canadian model building code introduce requirements to address the risk of loss and damage from wildland fire. The Canadian Commission of Building and Fire Codes, noting that there was not a consensus to go forward at the time, rejected this request in 2012 (Canadian Press 2012). Code officials indicated that local land use planning bylaws might be a better mechanism than building codes to address the hazard of wildland fire.

A brief history of wildland fire management

Fire has been present on the North American landscape for thousands of years. Wildfire is a natural phenomenon that is essential for the health of forests and grasslands. Many ecosystems have evolved to depend on fire to bring renewal and regrowth. This includes prairie, savanna and coniferous forests. Many plants and trees require fire to germinate and reproduce, while animals, in turn, are dependent on these grasslands and forests.

Fire is also a longstanding threat: lives have been lost and property destroyed by fire. This hazard has increased with more people living in the wildland-urban interface and active in the wildlands. Change in the climate is expected to significantly increase the area burned by wildfire and the risk of loss unless current fire practices adapt and evolve.

Prior to European settlement

Aboriginal groups across North America actively managed wildland fire for many generations prior to European settlement, resulting in profound changes to the landscape. Lightning brought natural fires that occasionally burned grasslands and forests, while intentional burning was conducted with greater frequency over smaller areas. Depending on need and circumstances, controlled burns may take place every one to three years. Moreover, intentional fires were at a different time of the season than natural fires that typically peak during the summer. In moist climates, intentional fire was used in the spring to control new growth, while in dry regions it was more common to set fires in the fall. The cycle of burning would be suspended during periods of prolonged drought due to the increased risk of fires burning out of control (Lewis 1982).

There were many reasons why aboriginal peoples actively managed fire, including hunting and protection of settlements. Fire could be used to divert deer, elk and bison into specific locations for easier hunting. Fire also increased the grasslands available to support larger herds of grazing animals and the food available to support the community. Regular burning near settlements reduced the threat to lives and property from catastrophic uncontrolled fire. Fire could also increase berry yields, reduce the cover that predators like wolves and bears may use to hide in, and ease movement through the wildlands.

Despite active efforts to manage the hazard, fire likely resulted in occasional periods of catastrophic loss of life and property. Natural periods of extended drought would leave grasslands and forests vulnerable to lightning or accidental ignition from a cooking fire, a peril beyond the capacity for management. Fire could destroy property accumulated over a lifetime, ruin crops and scare away prey. The largest loss of life may come from starvation and illness following the fire.



The wildlands in North America prior to European settlement had been shaped by many generations of natural and managed fire. In particular, fire management by aboriginal peoples had transformed some forests into grasslands and savanna, and where forests remain, fire was used to increase the open space between trees and remove underbrush.

European settlement

Fire management changed with European settlement. Available documentation indicates that settlers were largely unaware that the aboriginal community had actively managed the landscape. The objective in villages and towns was to suppress all urban fires. Lightning, campfires, sparks from a locomotive and other sources lead to an increased frequency of fires in the wildland. During very dry summers, large fire events destroyed settlements across North America. Hundreds of people were killed in emerging towns and villages, while the fate is unknown for thousands of men working in the forests (Pyne 1982).

Large fires sometimes burned through villages and towns across the continent. There was a tragic loss of life and distressing destruction of property. Some of the largest fire losses ever experienced in Canada include the Miramichi Fire in 1825, the Saguenay Fire in 1870, Cochrane Fire in 1911, Matheson Fires in 1916, the Great Saskatchewan Fire in 1919, and the Haileybury Fire in 1922 (McIntyre 2003). Hundreds of people lost their lives, and many villages and towns were destroyed.

Several communities in the United States were destroyed by the Great Fire of 1910, prompting the U.S. Forest Service to commit to a strategy of suppressing all forest and grass fires in the wildland. Governments across Canada soon adopted a suppression strategy for much of the country. Success for firefighters was measured in how soon a fire was identified and put out.

European settlement brought a new era for fire management, with a focus on fire exclusion in the wildlands. The result, at considerable cost, was a significant reduction of fatalities and property damage across Canada and the United States due to wildfire. This approach was sustained for several decades.

Toward a modern approach

In the 1980s and 1990s, a number of large loss events began to re-emerge in Canada and on a larger scale in the United States. Decades of fire exclusion had transformed the wildland. There was a significant accumulation of shrubs, bushes and undergrowth that was described by firefighters as "fuel". Moreover, the extended period of safety was one of the factors that encouraged more people to pursue recreation activities in the wildland and to live in the wildland-urban interface.

There has been a remarkable increase in the number of people in the United States who live in the wildland-urban interface, with the largest increases over the last few years. Data are not available for Canada but there is clear evidence that more Canadians are spending time in the wildlands and living in the interface, and these totals are expected to grow.

The Forest Service in the United States has withdrawn its commitment to suppress all fires in the wildland; nevertheless, firefighting efforts in Canada and the United States continue to focus on the early identification and suppression of fires in the wildland. The cost of fire exclusion has increased significantly over the past few decades, driven by the growing number of homes located in areas of risk and increased area burned. Some are questioning if this rising public cost can be sustained.

In 2005, a joint federal, provincial and territorial vision statement was released setting out a plan for managing fire risks through the *Canadian Wildland Fire Strategy*. This national vision seeks to establish a balance between actions to respond to wildfire, promote healthy forests, and build resilient communities. The vision statement has enjoyed strong support over the past decade from a broad range of stakeholders, although lack of funding continues to delay implementation.

One of the three core elements of the *Canadian Wildland Fire Strategy* involves the establishment of resilient communities and an empowered public. FireSmart Canada is the leading organization supporting community action in Canada to address wildfire.

In the 1990s, Partners in Protection created FireSmart with support from the Alberta Forest Services and a number of other partners. FireSmart Canada provides information about actions that should be taken by communities and individuals to protect themselves from the risk of wildland fire.

Partners in Protection continues to operate FireSmart as the national program seeking to protect lives and property across the country from wildfire damage despite the meagre financial support from the federal, provincial and territorial governments. One of the first documents produced by FireSmart was *Protecting Your Community from Wildfire*. This report sets out specific actions that can be taken at the community level by local governments and other stakeholders. This includes advice on planning tools available to local governments.

In the United States, there are many organizations pressing for greater local participation in wildfire management. For example, the American Planning Association has been providing wildfire advice to local planning officials since 2004, with reports like *Planning for Wildfire* (Schwab, Meck and Simone 2004). In Canada FireSmart has virtually been alone in the provision of local advice and support.

Development of a national vision for wildland fire management, provincial and territorial governments spending billions of dollars on fire suppression, and the welcome leadership by FireSmart Canada to promote community preparedness, are welcome advances in Canada's management of wildland fire. Nevertheless, wildland fire loss and damage is rising. In particular, Canada experienced its largest wildland fire damage events in 2003 and 2011, including hundreds of homes destroyed in Kelowna and Slave Lake. Moreover, the number of Canadians living in the interface and visiting the wildland continues to grow and evidence is mounting that change in the climate will significantly increase the expected area burned. Increased loss and damage is expected unless further change occurs.

As a result of recent major wildfire events in Canada, property owners and their communities are taking on more significant roles in protecting themselves. In addition to the FireSmart initiative, community planning and development permits, many communities have also begun to expand their abilities to deal with wildfires. This includes cross-training community firefighters in wildfire control techniques and coordination with wildland fire firefighters. Some communities have purchased wildland compatible fire engines and wildfire sprinkler systems for local deployment.

Drivers increasing the risk of loss and damage

Many factors affect the risk of wildland fire. Two drivers that are expected to push the risk higher over the coming decades are the number of people living in the urban-wildland interface and climate change.

A growing population living at risk

Since 1980, there have been millions of acres burned across Canada with little loss and damage. Fire management and suppression has been successful in preventing loss of life, injuries and damage to property. Beverly and Bothwell 2011 found that only one Canadian was killed by wildland fire in the period between 1980 and 2007, while three others died as a result of the stress associated with evacuations.

The number of Canadians living in the interface is unknown. On average, 7,500 Canadians are ordered to evacuate each year because of the risk of wildfire (Beverly and Bothwell 2011). Hundreds of homes were destroyed by fire in Slave Lake, Kelowna and a number of other communities. The population at risk includes people living in the wildland-urban interface and people that visit the wildlands. There is widespread agreement that the number of Canadians that live, work and play in the wildlands is growing.

The number of people living in the interface in the United States increased from 25 million in 1960 to now exceed 140 million (Bailey 2007). The number of homes in the interface has grown rapidly over several decades, including permanent residences and seasonal dwellings. The number of homes destroyed each year by wildfire in the United States increased ten-fold from 400 in the 1970s to more than 4,000 recently (Bailey 2007). A larger population at risk contributed to the increase in fire loss and damage.

Available data for Canada shows that the four provinces with the most homes destroyed by wildfire over the period since 1980 are Alberta, British Columbia, Manitoba and Saskatchewan (Beverly and Bothwell 2011). The largest loss of homes from wildland fire has been concentrated in Alberta and British Columbia, including several hundred homes lost in Slave Lake and Kelowna in fires during 2011 and 2003. More than 95 percent of the homes destroyed by wildfire in Alberta and British Columbia since 1980 were permanent homes while less than five percent were seasonal dwellings. The experience of permanent homes destroyed in Alberta and British Columbia has shaped the focus of public and policy maker attention.

In contrast, very few homes were destroyed by fire in the other provinces and territories since 1980, and more than half of these were cabins, cottages and other seasonal homes. There have been evacuations in communities at risk across Canada, but in most of the country the experience with buildings destroyed by fire has largely involved a relatively small number of seasonal dwellings.

Less than four percent of Canadians self-identify as aboriginals yet one third of the people evacuated since 1980 lived in First Nation communities (Beverly and Bothwell 2011). Most of these (88 percent) were located in Ontario, Manitoba, Saskatchewan, or Quebec. There are more than 750 aboriginal communities across Canada and most are located in zones of high wildland fire risk. Aboriginal communities are much more vulnerable to wildland fire than other communities across Canada, largely due to location. These communities face a wide range of socio-economic issues, including concerns about access to quality housing. The risk of loss from wildland fire is one of the many issues that need to be addressed.

Change in the climate

Fire frequency and intensity has long been highly correlated with climate conditions. Indeed, three critical factors that determine the area burned by wildfire include the frequency of ignitions, fire control activities and weather. Some weather factors that affect wildfire include temperature, precipitation, humidity, wind speed and the frequency of lightning (Flannigan 1990).



Evidence over several decades shows a high correlation between area burned and temperature (Gillett et al 2004). Projections of rising summer temperatures warn that the area burned each year in Canada is expected to double by the end of this century with warming of the climate (Flannigan et al 2009). Summer temperature is the most important long-term weather variable that predicts the expected area burned by wildfire.

Area burned is also highly correlated with periods of drought and long sequences without rainfall. A sequence of rain events, for example, makes a greater contribution to reduce the risk of wildfire than the same volume of precipitation falling in a single large rain event. Climate change is projected to increase the frequency of summer days with no rainfall across Canada.

Fire data also shows correlation between relative humidity and area burned. The impact of climate change on relative humidity is projected to further affect the area burned by wildfire. Wind conditions are important determinants of the speed that fire spreads in the wildland. At this point, it is unclear from the climate research what the impact of climate change will be on wind speeds.

Forest and climate research consistently finds that much of the recent fluctuation in area burned is a result of variation in the climate. While the relationships are complex, there is widespread agreement that temperature is the most important predictor of area burned, with the expected warming associated with climate change expected to significantly increase the area burned in Canada unless actions are taken to reduce ignitions and increase suppression.

Climate models have been used to anticipate the change in the climate and expected area burned across Canada. These studies consistently show large increases in the area over time, with one recent study projecting that the area burned by wildfire will increase by 74 to 118 percent by the end of the century (Flannigan et al 2009). All studies project a significant increase in wildland fire as a result of hotter, drier summers across most of Canada.

Studies anticipate an earlier start to the fire season and the length of the fire season is expected to increase. A much larger area is expected to experience high to extreme fire risk with change in the climate. Indeed, fire may move beyond our forests and grasslands to include peatlands. Nevertheless, most of the increasing wildland fire risk is expected to remain concentrated in Canada's Boreal forest, Taiga and Montane Cordillera.

Elements of a comprehensive fire management strategy

In 2005, the Canadian Council of Forest Ministers issued the *Canadian Wildland Fire Strategy* setting out a shared national vision for managing the risk of fire. The elements of the desired future state set out in the vision included resilient communities and an empowered public, healthy and productive forest ecosystems and modern business practices for responding to wildfires. These critical elements would provide the foundation for a modern, national fire management strategy.

As Canada continues to work toward implementing a national strategy, several local governments have begun providing leadership at the community level. For example, a comprehensive community fire management plan is essential to build resilient and empowered communities. The national vision has strong support from a broad range of stakeholders, and awaits a clear commitment to ensure implementation. The vision can provide a guide for stakeholders, including local governments, to take action now even if it is unclear when the federal, provincial and territorial governments will fully commit to implement the agreed upon national wildland fire strategy.

Healthy forests and grassland ecosystems

Our forests and grasslands are not in the best health. Decades of population growth, urbanization, fire exclusion, infestations and poor forest management practices have disrupted our wildlands. A sustainable and vibrant future for Canadians should include long-term actions to establish and maintain healthy forests and grasslands. Fire should be embraced as essential for healthy and diverse ecosystems. Fire exclusion policies in the wildlands must give way for most of our forests. There is a national consensus that policy emphasis in the wildlands should shift to increasingly protect point values like homes, key watersheds and critical stands of lumber rather than exclusion (*Canadian Wildland Fire Strategy* Vision 2005).

Adaptive forest management should maintain or enhance the ecological integrity and productivity of the forest ecosystems while protecting the material values of society. Fire suppression is more effective when it is used in combination with prescribed burns, thinning and other proactive fuels management strategies. Aggressive, national efforts to confront infestations, like the Mountain and Western Pine Beetles, are also essential to ensure healthy forests.

Landscape fire planning and management is an important approach to reduce the risk of loss from interface fire. Fuel reduction, modified response fires, modified stocking standards and other harvest treatments can be used to create a more fire resilient landscape in the wildlands and the interface (Osbourne et al 2013). Qualified professionals can best plan for where fire is beneficial or detrimental, and critical areas can be targeted for ecological restoration or prescribed burns to create a more fire resilient landscape.

Capacity to fight wildland fires

Wildland fire management professionals have successfully defended Canadians from loss of life and destruction of property for many decades. These brave individuals and their successors are a critical part of a modern wildland fire strategy. They need and deserve the appropriate training, equipment and other resources to continue to succeed in protecting Canadians at risk.

Climate change is expected to significantly increase the area burned, while the population living in the wildland-urban interface continues to grow. Provincial and territorial governments should plan for a material increase in the cost of fire monitoring and suppression. Increased costs will likely be sustained over several decades.

Canadians who choose to spend time in the wildlands and live in the wildland-urban interface need to increasingly accept responsibility for their safety and that of others. More aggressive actions should be taken to confront the increase in accidental fires and arson. Moreover, there should be greater clarity about the importance of firefighter safety and the circumstances when it is acceptable to permit structures to be lost to fire.

Resilient and empowered communities

Perhaps the greatest scope to re-establish control over the risk of loss from wildland fire involves the opportunity to educate and involve Canadians in fire management. The public needs to learn about the importance of fire for the health of ecosystems. Moreover, Canadians need to understand the actions they can and should take to minimize the risk that they create when they choose to live near wildland areas.

An empowered public can strengthen the fire resilience of communities through investments in fire-resistant homes and participation in actions to make their community FireSmart. Through the informed actions of many people, Canadians can pursue a comprehensive set of risk management actions that enhance society's capacity to live successfully with the growing hazard of fire in the wildlands.

All three elements are essential to a national wildland fire strategy. A particular challenge involves securing participation of the public in recognizing and addressing this hazard. Exclusion of fire from urban areas is an approach that should not continue throughout the wildlands, despite several decades with few fatalities and relatively little property damage. For several generations, success in wildland fire management has been measured in the speed of detection of ignitions and minimizing the time required to suppress the fire. Public understanding and expectations need to change in the coming decades, ideas that may be difficult to explain to an increasingly urban population.

The emerging role of Development Permits

A growing number of communities located in the wildland or at the wildland-urban interface have developed a community wildland fire management plan. Most communities in Canada with a wildfire management plan identify the FireSmart Canada report *Protecting Your Community from Wildfire* as the template used to develop a plan. The planning guide was published in the 1990s and revised in 2003.

FireSmart Canada has also launched a community recognition program. They provide local training and a manual for homeowners. FireSmart is the national program championing actions by property owners and communities to address wildland fire. Importantly, the program was founded through a partnership model that enhances the capacity of the effort to serve the interests of a broad range of public and private sector stakeholders despite a very modest budget. The federal, provincial and territorial governments should provide increased funds to FireSmart Canada to support this important work.

Many community management plans in Canada also reference documents from the National Fire Protection Association (NFPA) in the United States. This includes NFPA 1144, the Standard for Reducing Structure Ignitions Hazards from Wildland Fire, a document that has evolved over the past 80 years from the 1935 NFPA 224 standard, Fire Protection and Prevention for Summer Homes in Forest Areas. NFPA is recognized as the international leader in wildland fire management best practices.

Some community plans make direct or indirect reference to the FireWise program in the United States, state actions in California and Colorado, fire management practices in Australia and other international efforts. The forest management practices in Canada, the United States and Australia have many similarities and provide useful opportunities for shared learning about practices that can be applied in Canada.

The insurance industry is an emerging stakeholder supporting community actions to address wildland fire risk. The Institute for Catastrophic Loss Reduction has supported FireSmart for more than a decade, including an annual workshop to inform the insurance industry about wildfire, has conducted a showcase home retrofit with FireSmart, and published several research papers on aspects of wildfire risk reduction.

Communities that have developed a comprehensive wildland fire management plan consistently identify opportunities for many stakeholders to contribute, including a role for planning actions by local governments. The plans often include specific recommendations for local bylaws to control the nature, location and site features of new construction. Several communities in Canada have enacted or modified land use planning bylaws, while changes are under consideration in other communities.

The preparation of a comprehensive community wildland fire plan can provide a foundation for enacting local wildland fire management bylaws. Communities that have completed wildfire plans acknowledge the importance of financial support to complete this work. In British Columbia, the Community Wildfire Protection Program was launched in 2004 and administered by the Union of British Columbia Municipalities with funding from the Ministry of Forests, Land and Natural Resources. This popular program helps local governments to prepare community wildfire protection plans, develop fuel management prescriptions, implement fuel management demonstration projects and operate fuel management activities.

Local government Development Permits

Several communities have enacted wildfire bylaws regulating construction of new residential development. Some of these include Swan Hills, Alberta and Campbell River, Nelson, the District of North Vancouver, Prince George, Radium Hot Springs, Rural Saanich, Summerland, Rural Vernon and Williams Lake in British Columbia. A number of other communities have developed detailed regulations and are moving toward implementation including Greater Bragg Creek and Hinton in Alberta; and Kamloops, Kelowna, Langford and Maple Ridge in British Columbia.

Development permit regulations must be specified in the Official Community Plan, and as such require public consultation before they are enacted. There is often resistance to proposals to change development permit requirements owing to concern about increased cost imposed on developers and property owners.

There is large variation in the specific wording of the wildfire bylaws and the regulatory expectations across these communities. Moreover, bylaw requirements are one element of a range of wildfire safety activities pursued by these governments such as outreach programs using FireSmart, and operational activities by local governments to remove fuel and reduce the risk of wildland fire in the community.

The local wildfire bylaws consistently address three issues – acceptable building materials, landscape and site considerations, and the identification of zones where the high risk of wildland fire will result in the prohibition of new residential development unless construction and site considerations are met. Community planning regulations from more than a dozen communities in British Columbia and Alberta dealing with acceptable building materials are summarized in Appendix I, and landscape considerations in Appendix II.

Regulating the design and construction of homes

Wind can blow embers from a wildfire forward and they may land in the community. This risk is greatest for the homes located near the wildland, but embers can land on homes some distance into the community. If an ember lands on a structure with a roof that is not fire resilient, then the building may ignite and threaten to spread to neighboring homes. The risk of fire entering a community from embers carried in the wind can be addressed through the installation of fire-resistant roofing, and wire screens on eaves and roof vents.

Wildfires can also burn into a community, initially threatening buildings on the immediate wildland-urban interface, but ultimately spreading through the community. This risk can be reduced through the installation of fire-resistive exterior walls, decks coated with fire-resistive materials, and windows fitted with tempered glass or double-glazed windows to protect against windblown debris that can break windows and allow fire to enter the home.

All of the communities identified in Appendix I include or are planning for a bylaw requiring fire-resistive roofing for new residential development in zones of high wildland fire risk. FireSmart, the Institute for Catastrophic Loss Reduction and others, consistently report that the single greatest risk of bringing fire into the community comes from homes with a untreated wood shake roof or other roofing not classified as fire resilient. The details of acceptable roofing materials vary across the communities, but consistent and appropriate attention is focused on the importance of fire-resilient roofing.

There is considerable variation with respect to additional regulation of the building materials that are required for new residential development in areas with a high risk of wildland fire. Some communities have no building materials requirements beyond roofing, like Swan Hills, while many have a comprehensive list of requirements, such as Nelson, North Vancouver, and Williams Lake. Some communities, like Nelson, are very specific in the identification of acceptable and unacceptable building materials, while others identify the public safety objective but are unclear about the specific building materials required. Swan Hills and Greater Bragg Creek seek to regulate roofing for all structures throughout the town, while the remaining communities focus on new home construction in zones with high fire risk.

Landscape regulations to keep fire out of the community

FireSmart has identified three zones of protection for structures in the wildland-urban interface. They advise the elimination of fuels to provide a defensible space of at least 10 metres around a home. For homes on a slope, this zone should be larger. The zone extending up to 30 metres around a home should have reduced fuels and the zone beyond 30 metres should be managed, where possible, to provide fire breaks and other protective actions for the community. All of the communities identified in Appendix II have embraced the concepts of defensible space around the home and have enacted or are working on implementing bylaws to achieve these objectives. Some communities, like North Vancouver and Campbell River focus primarily on the first 10 metres around the home. Others, like Swan Hills, use the three zones as identified by FireSmart.

Many communities specifically recognize FireSmart in the wildfire landscape regulations and bylaws they have enacted or are developing, and all have adopted actions that are consistent with the practices set out by FireSmart. The bylaws across the various communities are more consistent for landscape considerations than for building materials.



Some communities, like North Vancouver, introduced additional elements to reduce the risk that new developments would increase the risk of fire spreading from buildings into the forest. North Vancouver also can demand a retention/restoration plan from a professional arborist and replanting of trees lost during development. Summerland requires, and Kelowna encourages, lawns irrigated by an underground sprinkler system as a means of suppressing the risk of wildfire destroying the home. Langford has proposed a \$1,000 a year “rent charge” for homes that fail to maintain reduced fuels within 10 metres of their homes.

Prohibiting new residential development

All of the communities in British Columbia and Alberta identified in the Appendices have established or are establishing the authority through their land use planning regulations to prohibit new residential development in zones with high risk of wildland fire unless specific covenants are met. For many decades, local governments have been using land use planning as a critical tool for managing the risk of flood damage by prohibiting development in areas where there is a known risk of flooding. These communities are now also using their planning authority to manage the risk of wildland fire.

Regulations to require that property owners establish and maintain a defensible zone surrounding buildings are not consistent with provincial and territorial building codes and can best be implemented through local government bylaws, as has begun to emerge in some communities in British Columbia and Alberta. Swan Hills and Greater Bragg Creel are seeking to regulate the establishment and maintenance of defensible space around all structures in the community – not just homes in new developments.

Regulation to require fire-resilient building materials for new homes could be enacted through provincial and territorial building codes, or through local bylaws. Provincial and territorial governments have chosen not to address this issue yet so local government action is required. A result to date is inconsistent action across British Columbia and Alberta. Important differences between communities in terms of building regulations introduces additional cost for home builders, insurance companies and some other stakeholders that operate on a regional or national level but now need to ensure compliance with local requirements.

There are hundreds of communities across Canada located in the wildland-urban interface. At least 10 communities in British Columbia and Alberta have established bylaws to regulate new residential development to take into account the risks of wildland fire. Half a dozen other communities are advanced in their efforts to revise their bylaws and practices. Most communities, however, have yet to take action and can learn from these leaders. The growing number of Canadians that spend time in the wildlands and live in the wildland-urban interface, combined with growth in the expected area burned by wildfire due to change in the climate is expected to increase the risk of loss and damage from wildland fire over the next few decades. Nevertheless, most fire losses are preventable. Several communities are showing that local government planning actions, like development permits, can be part of a comprehensive community plan to manage the risk of wildland fire.

Three communities taking action

Several communities have chosen to use planning tools within their local bylaws to address the risk of wildfire in the wildland-urban interface. There are large variations in the specific actions adopted but the common overall objective is to ensure that new development brings homes designed for the risk of fire and that development does not increase the hazard for the rest of the community. The actions taken in Nelson, British Columbia, Swan Hills, Alberta and the District of North Vancouver, British Columbia provide an overview of the range of planning actions that have been taken by local governments.

Nelson, British Columbia

Nelson is a community of 10,000 people living in the Southern Interior of British Columbia. Known as the “Queen’s City”, Nelson is located in the Selkirk Mountains. Nelson experiences hot, dry summers and is located in a region that regularly experiences wildfire.

The official community plan bylaw for Nelson includes four pages of wildfire interface design guidelines in its development permit area regulations. The first page is a map of the community identifying the specific locations in the wildland-urban interface on the southern side of Nelson where the wildfire development regulations apply. A subdivision application and building permits within the designated “Wildfire Interface Zone” are subject to special approval.

The second page sets out the landscaping requirements for site approvals. Referencing the three priority zones identified by FireSmart, Nelson requires no combustible material within 10 metres of a new home, reduced combustible materials within 10 to 30 metres with trees spaces at least 3 to 6 metres apart and no evergreens, and specific requirements for reduced combustibles 30 to 100 metres from each new home.

The third page identifies allowed, encouraged and not permitted building materials for new homes. Nelson requires a roof and siding that is fire-resilient, and requires screened soffits. The use of double paned or tempered glass windows is encouraged. The bylaw identifies the specific building materials that satisfy or would fail to satisfy these requirements. Allowed siding, for example, identified in the bylaw includes stone, brick, stucco, fibre-cement boards, concrete block and pre-finished metal sheeting. Siding that is not permitted includes wood siding, shingles or shakes. Allowed roof materials include metal, asphalt, fire-retardant wood shingles and shakes, fire-rated recycled composite shingles, concrete tiles, ceramic tiles, and flat bitumen based roofing. Not permitted roofing is untreated wood shingles or shakes.

The fourth page reprints a graphic from the FireSmart homeowners manual describing 18 actions homeowners should take to protect their property from wildland fire.

Communities across Canada could readily adopt the approach used by Nelson in seeking to apply local planning authority to address the hazard of fire for new homes in the wildland-urban interface. The items addressed represent the major risks of damage from wildfire. Nelson is specific in the building materials required to secure approval, in contrast to the ambiguity found in some other jurisdictions.

Swan Hills, Alberta

Swan Hills is a town with about 1,500 citizens in Northern Alberta. In 1967, Swan Hills was incorporated as Canada's first centennial town. The town is located near the geographic centre of the province. Swan Hills supported growth in the oil and gas industry in the 1950s and 1960s, and is a local hub supporting hunting, fishing and a broad range of other recreation activities that take place in the surrounding wildlands. The town is located in the Northern Boreal forest in a region subject to recurring wildfires.

The town's land use bylaw is 107 pages in length. The bylaw includes a section setting out FireSmart Regulations for Dwellings and Structures and a three-page appendix identifying fire-resistant plants.

"Every residence is required to have its house number clearly displayed near the front door entrance and easily visible from the street."

"The Town requires all property owners to undertake vegetation management within 10 metres of a building. This is intended to create a fuel modified area in which flammable vegetation surrounding a building is eliminated or converted to less flammable species. The fuel-free zone is immediately adjacent to a given building and extends outwards in all directions for a minimum of 10 metres, and includes the following practices: Flammable forest vegetation shall be removed; all conifer limbs shall be removed to a minimum height of 2 m from the ground on residual overstory trees; annual grasses shall be mowed to 10 cm or less; and, no combustible material piles (firewood, lumber, etc.) shall be allowed."

"The Town requires that roofing on all structures be ULC (Underwriter Laboratory of Canada) fire-rated."

Swan Hills chose to include these regulations in the Part 6 General Regulations section of the Town's land use bylaw rather than Part 3 dealing with development permits. Accordingly, the bylaw for Swan Hills appears to apply to new and existing homes in the town. Most other communities assessed in this study chose to focus on regulating new residential development, often combined with public outreach to existing homeowners. Swan Hills has used its planning bylaws to address the risk for all properties. Installation of fire-rated roofing and vegetation removal adjacent to all structures will significantly reduce the risk of fire entering Swan Hills. Moreover, the wording of the bylaw implies that the regulations apply to permanent homes and also to commercial buildings, seasonal dwellings and all other structures in the town, perhaps including garages and sheds. Dealing with all structures in a general regulation bylaw is a powerful way to use planning tools to contribute to a comprehensive community wildland fire plan.

A further research opportunity would involve assessing the powers and capacity of the town of Swan Hills for enforcement of these FireSmart regulations on existing homes. Also, has the town considered allowances, if any, for compliance by existing homeowners with low incomes or other special circumstances? A lesson from Swan Hills is that local regulations can be used to address the risk of wildland fire in the community not only for new residential development but also for existing buildings and structures.

District of North Vancouver, British Columbia

The District of North Vancouver is a community of about 85,000 people surrounding the 50,000 people living in the City of North Vancouver. It is located on the slopes of the Coast Mountains across the Burrard Inlet from Vancouver. Most of the growth in the community has taken place since 1950.

The District won the Sasakawa Award from the United Nations for leadership in disaster risk reduction, and has been recognized as a Role Model City for the United Nations' Resilient Cities campaign. In particular, the community is pioneering the efforts by local governments to apply risk management best practices to the risk of loss from natural hazards including landslides, debris flow, earthquake and wildfire.

The District issued a 25-page document setting out requirements for new development permits in natural hazards zones. One section sets out the objectives of the District when it considers an application. Another section identifies the fire-resistive materials and construction practices required. Another section sets out landscaping requirements. And there are requirements that vegetation and construction debris should be removed within three months of permit issuance, or immediately during high fire seasons. And the District may require that a tree assessment and restoration plan be completed by a professional arborist.

North Vancouver requires that new homes in wildfire areas use fire-retardant roofing, and asphalt or metal roofing should be given a preference. Decks, porches and balconies should be sheathed with fire-resistive materials; all eaves, attics, roof vents and openings under floors should be screened to prevent the accumulation of combustible material, using 3 mm, non-combustible wire mesh, and vent assemblies should use fire shutters or baffles; exterior walls should be sheathed with fire-resistive materials; fire-resistive decking materials, such as solid composite decking materials or fire-resistive treated wood; all windows should be tempered or double-glazed to reduce heat and protect against wind and debris that can break windows and allow fire to enter the home; all chimneys and wood burning appliances should have approved spark arrestors; and building design and construction should be consistent with NFPA 299.

A number of regulations have also been set out concerning the siting of new development if it is to be allowed in wildfire hazard zones. New building construction should include the use of firebreaks, which may be in the form of cleared parkland, roads, or utility right of ways; all new hydro servicing should be underground; wildfire mitigation and landscaping techniques should ensure that natural features of the site and adjacent ecosystems are protected, preserved and enhanced in accordance with District bylaws; if removal of trees or vegetation is deemed necessary to reduce risk, District approval is required and replacement trees or vegetation may be required by the District; and a defensible space of at least 10 metres should be managed around structures with the goal of eliminating fuel and debris, reducing risks from approaching wildfire and reducing the potential for building fires to spread to the forest, and the required defensible space may be larger over sloping ground where fire behaviour creates greater risk.

The commitment throughout the hazard work of the District of North Vancouver is to proactively manage the risk of loss and damage from landslide, debris flow, earthquake and wildfire for the benefit of present and future generations. The risk-based natural hazard development permit regulations in the District of North Vancouver provide a model that local governments across Canada should consider for the regulation of wildland fire and other natural hazards.

Conclusions

Fire has been present in our forests and grasslands for thousands of years, and is essential for the health of our ecosystems. Fire is also a threat to the life and safety of Canadians, with a risk of loss and damage that is projected to increase over the next few decades due to growth of the number of people who live in the wildland-urban interface and to change in the climate. For the past century, we sought to exclude fire from urban centres and the wildlands. The policy of exclusion is now evolving into a more complex, multi-stakeholder approach to fire management in the wildland.

In 2005, the Canadian Council of Forest Ministers established a shared national vision for managing wildland fire. The federal, provincial and territorial governments have yet to implement that national strategy, nevertheless several local governments have begun to take action to address wildfire risk in their communities. Local action includes developing a community wildland fire management plan. Within these plans, more than a dozen local governments in British Columbia and Alberta are using or preparing to use their land use planning authority to increase safety in their communities through bylaws and regulations dealing with wildland fire.

Development permits are a local planning tool that some local governments have begun using to require that new homes are built using materials that reduce the risk of fire entering the community, and that residential development includes defensive space surrounding new structures with reduced fuels. Most importantly, local governments are using their planning authority to prohibit and control new development in areas with high risk of wildland fire unless specific actions are taken to mitigate the risk.

The use of local government planning tools to address wildfire emerging in British Columbia and Alberta is likely to spread across Canada. For example, in June 2014, a revised Provincial Policy Statement by the Government of Ontario introduced new requirements for local governments under the Planning Act. Local governments in Ontario are now required to use their planning powers to address flood and wildfire. "Development shall generally be directed to areas outside of lands that are unsafe for development use due to presence of hazardous forest types for wildland fire. Development may however be permitted in lands with hazardous forest types for wildland fire where the risk is mitigated" (Ontario 2014).

Local governments have been leaders in reducing the risk of flood loss and damage through land use planning and are emerging as leaders in community wildland fire management. Nelson, Swan Hills and the District of North Vancouver are three communities that provide specific examples of planning regulations that can and should be followed by other communities across Canada in seeking to address the public safety concerns from the growing risk of loss from wildland-urban interface fire.

The focus of this paper has been on the leadership that is being provided by local governments. Provincial and territorial governments could also seek to encourage or compel local action. One option could be to circulate to local governments draft development permit regulations, perhaps using the District of North Vancouver or Nelson as models. Alternatively, draft development permit regulations could focus on site and landscaping issues, as set out in the FireSmart community planning guide, and the province or territory could modify its building code to address fire-resilient construction, perhaps as set out in NFPA 1144. Finally, local governments could be encouraged to address the risk of wildfire for all buildings, new and existing, through draft general bylaws. Swan Hills and Greater Bragg Creek are communities seeking to use planning regulations to reduce the wildfire risk for all structures. Additional research into actions underway in Colorado, California and Victoria, Australia, may provide additional guidance.

Unless current approaches change, loss and damage from wildland fire is expected to increase in Canada over the next several decades due to factors that include growth in the number of people living in the wildland-urban interface and change in the climate. Change is needed from many stakeholders. Local governments are emerging as important participants in wildland fire management. Development permits and other local government planning tools should be elements of a comprehensive community wildland fire strategy in a changing climate.



References

- Bailey, D.W. (2007) The Wildland/Urban Interface Crisis, Is There a Solution? International Association of Wildland Fire. 17 pages. Available online: www.iawfonline.org/WUI%20WARS%20ARTICLE%20DAN%20BAILEY.pdf
- Beverly, J.L. and P. Bothwell (2011) "Wildfire Evacuations in Canada 1980-2007." Natural Hazards, Springer, Volume 59 pages 571-596.
- Canadian Council of Forest Ministers (2005) *Canadian Wildland Fire Strategy Declaration*. Canadian Council of Forestry Ministers, Natural Resources Canada, Canadian Forest Service, Edmonton, Alberta. 1 page
- Canadian Press (2012) "Building Codes Changes Rejected for Wildfire Prone Areas: Proposal Submitted Before Wildfire Destroyed Hundreds of Homes in Slave Lake Alta". Canadian Press story published by CBC at 10:33 am on December 3, 2012. 3 pages. Available online: <http://www.cbc.ca/news/canada/edmonton/building-codes-changes-rejected-for-wildfire-prone-areas1.1177036>
- Canadian Wildland Fire Strategy Assistant Deputy Ministers Task Group (2005) *Canadian Wildland Fire Strategy: A Vision for An Innovative and Integrated Approach to Managing the Risk*. A Report to the Canadian Council of Forest Ministers, Natural Resources Canada, Canadian Forest Services, Edmonton, Alberta. 18 pages.
- Flannigan, M.D. and C.E. Van Wagner (1990) "Climate Change and Wildfire in Canada". Canadian Journal of Forest Research, NRC Research Press. Pages 66-72.
- Flannigan, M.D. et al (2009) "Implications of Changing Climate for Global Wildland Fire" International Journal of Wildland Fire Volume 18. Pages 483-507.
- Gillett, N.P. et al. (2004) "Detecting the Effect of Climate Change on Canadian Forest Fires" Geophysical Research Letters, Volume 31, 4 pages.
- Hirsch, K.G. and P. Fuglem (2006) *Canadian Wildland Fire Strategy: Background Syntheses, Analysis and Perspectives*. Canadian Council of Forestry Ministers, Natural Resources Canada, Canadian Forestry Service, Edmonton, Alberta. 104 pages.
- Lewis, H.T. (1982). A Time for Burning. Occasional Publication No. 17, Edmonton Alberta: University of Alberta, Boreal Institute for Northern Studies. 62 pages.
- McGee, T.K. et al. (2009) Human Dimensions of Fire Management at the Wildland Urban Interface in Alberta: A Summary of Findings. Institute for Catastrophic Loss Reduction, Research Paper No. 46, Toronto. 18 pages.
- McIntyre, T. (2003) "Canada's Incendiary Past: Fires That Have Burned Their Way into Canadian History" Canadian Geographic Magazine In-Depth, 2 pages. Available online: <http://www.canadiangeographic.ca/Magazine/ja03/indpeth/timeline.asp>
- Province of Ontario (2014) Provincial Policy Statement: Under the Planning Act. Ministry of Municipal Affairs and Housing, Provincial Planning Policy Branch, Government of Ontario, Queens Printer for Ontario. 52 pages. Available online: www.mah.gov.ont.ca/AssetFactory.aspx?did=10463
- Osbourne, K. et al. (2013) Landscape Fire Management in British Columbia B.C. Forest Professional. 1 page. http://www.abcfp.ca/publications_forms/bcformagazine/documents/BCFORPRO-2013-01-Osborne.pdf
- Pyne, S.J. (1982) Fire in America: A Cultural History of Wildland and Rural Fire. Princeton, NJ: Princeton University Press. 654 pages.

Schwab, J., S. Meck and J. Simone (2004) *Planning for Wildfire* American Planners Association Planning Advisory Service Report 529/530. 124 pages.

Tindall, C.R. et al. (2012) *Local Government in Canada* 8th Edition. Nelson Education. 505 pages

Local Government Wildland Fire Bylaws or Proposed Regulations

Campbell River, B.C. Available online: <http://www.campbellriver.ca/docs/defaultsource/DocumentLibrary/permits/interface-fire-hazard-developmental-permit-area.pdf?sfvrsn=5>

Greater Bragg Creek, Alberta. Available online: <http://www.rockyview.ca/Portals/0/Files/CountyServices/FireEmergency/Greater-Bragg-CreekFireSmart-Mitigation-Strategy.pdf>

Hinton, Alberta. Available online: <http://www.hinton.ca/DocumentCenter/Home/View/612>

Kamloops, B.C. Available online: <http://www.city.kamloops.bc.ca/firerescue/pdfs/14-CWP-Plan.pdf>

Kelowna, B.C. Available online: <http://www.kelowna.ca/CityPage/Docs/PDFs/Parks/11-05-11%20DHC%20Report%20-%20Kelowna%20CWP%20Electronic.pdf>

Langford, B.C. Available online: <http://www.cityoflangford.ca/assets/Documents~Library/Brochures/firehazard-planning-model.pdf>

Maple Ridge, B.C. Available online: <http://www.mapleridge.ca/DocumentCenter/View/1049>

Nelson, B.C. Available online: <http://www.nelson.ca/assets/City~Services/Development~Services~and~Sustainability/Sustainability/Schedule%20H%20-%20OCP%20Bylaw%203247.pdf>

North Vancouver, B.C. Available online: <http://www.dnv.org/upload/pcdocsdocuments/15vzn01!.pdf>

Prince George, B.C. Available online: <http://princegeorge.ca/citybusiness/currentplanning/zoningbylaw/Documents/00-full.pdf>

Radium Hot Springs, B.C. Available online: http://www.radiumhotsprings.ca/sites/default/files/OCP_Bylaw_396_Schedule_1.pdf

Rural Saanich, B.C. Available online: http://www.saanich.ca/living/pdf/DPA%20Guidelines_November%202006_Printing_updated_August%202014_smaller.pdf

Rural Vernon, B.C. Available online: http://www.rdno.ca/bylaws/1708_rural_vernon_ocp.pdf

Summerland, B.C. Available online: http://www.summerland.ca/docs/docs_forms/bylaws/Official%20Community%20Plan/Official%20Community%20Plan%20_2008_%20No.%202000-310.pdf

Swan Hills, Alberta. Available online: <http://www.townofswanhills.com/images/LUB%202012-14.pdf>

Williams Lake, B.C. Available online: <http://www.williamslake.ca/DocumentCenter/View/291>

Appendix I: Local building design and construction regulations

	Roofing	Exterior walls	Other
Campbell River B.C. Bylaw No. 3475, 2012	See "Other"	See "Other"	For new development in high risk interface fire hazard areas, applications must be accompanied by a wildfire assessment and interface mitigation plan prepared by a qualified professional that minimizes the risk associated with the proposed development/building concept.
Greater Bragg Creek Alberta Proposed: Jan 2012	See "Other"	See "Other"	Establish and implement FireSmart standards for exterior building materials for all new developments and retrofits of existing structures. Establish a powerline tree-freeing program with the distribution power provider to reduce the threat of wildfire ignition from downed powerlines.
Hinton Alberta Proposed: Jan 2011	See "Other"	See "Other"	Where appropriate, new subdivision and development applications deemed to be in High or Extreme FireSmart hazard areas, as per Map 3, shall submit a Wildfire Risk Assessment, prepared by a qualified FireSmart professional, in accordance with the requirements of the Town of Hinton. Wildfire Risk Assessments will be the landowner's responsibility and will include an evaluation of current and proposed FireSmart hazard and recommended FireSmart mitigative measures to be completed by the developer in conjunction with subdivision construction.
Kamloops B.C. Proposed: Jan 2008	All roofing materials and installation requirements meet the Class "B" fire-rating requirements contained within the current B.C. Building Code (currently enforced)	See "Other"	All eaves, attics, decks and openings under floors are screened to prevent the accumulation of flammable material (currently enforced). All wood burning appliances are to be installed with approved spark arrestors (currently enforced). As a minimum, be consistent with the current FireSmart guidelines. Be based on a completed site specific wildfire hazard assessment. Address building construction standards.

	Roofing	Exterior walls	Other
Kelowna B.C. Proposed: May 2011	Use only fire-retardant material (Class A materials) on roofs.	Siding should be predominantly fire-resistant material. Siding should extend from the ground level to the roofline.	<p><i>Wood Chimneys</i></p> <ul style="list-style-type: none"> All chimneys should have approved spark arrestors (securely attached and made of 12-gauge welded or woven wire mesh screen with mesh opening of less than 12 mm); Chimney outlets should have at least 3 meters clearance from all vegetation and obstructions; and Chimney outlets should be 0.6 m higher than any part of the roof within 3 meters. <p><i>Windows and Door Glazing; Eaves, Vents and Openings</i></p> <ul style="list-style-type: none"> Remove vegetation from within 10 meters of glazed openings unless there are solid shutters to cover the glazing; All eaves, attics, and underfloor openings need solid, non-flammable protective covers; and Laminated glass and 20 minute rated door assemblies should be used on building surfaces facing the forest interface. <p><i>Balcony, Decks and Porches</i></p> <ul style="list-style-type: none"> Deck surface material should be made of predominantly non-combustible or fire-resistant materials such as wood composite products; Slotted deck surface allow needle litter to accumulate beneath the deck. Provide access to this space to allow for removal of this debris. <p><i>Guidelines during Construction</i></p> <ul style="list-style-type: none"> During construction of houses, all waste construction materials including brush and land clearing debris needs to be cleaned up on a regular basis to minimize the potential risk. No combustible materials should be left at the completion of construction; Prior to construction of any wood frame buildings, there must be fire hydrants within operating range. <p>When planning new developments, underground power line systems should be considered. Where such a system is not feasible, overhead utility lines should have a clearance of at least 3m from vegetation.</p>

	Roofing	Exterior walls	Other
Langford B.C. Proposed: 2002	All roofing material and insulation requirements meet the Class "B" fire-rating requirements contained within the current B.C. Building Code.	May include recommendations for relaxations to restrictions on exterior building materials and roof sprinklers if resulting development changes the actual level of the risk from extreme or high to moderate or low. All buildings within 30m of a high or extreme wildfire risk area as identified by the Registered Professional Engineer must include fire-resistant construction materials for exterior siding and roofing.	<p>All eaves, attics, decks, and openings under floors are screened to prevent the accumulation of combustible material.</p> <p>All wood burning appliances are to be installed with spark arresters.</p> <p>For developments that only have one access route, exterior sprinkler systems on dwellings for protection against exposure fires are encouraged.</p> <p>Because of the potential for interface wildfires to interfere with hydro service to developments, and thus interfere with residential sprinkler systems, all hydro servicing in new developments within high and extreme interface fire hazard areas is encouraged to be underground and is required for developments of four (4) or more lots of urban density (i.e. lots less than 1,000 sq.m.).</p> <p>Building design and construction shall generally be consistent with the standards in the National Fire Protection Association Standard 299 (Standard for Protection of Life and Property from Wildfire).</p>
Maple Ridge B.C. Proposed: July 2007	In new subdivisions within identified high risk areas of the District, roofing materials that are fire retardant with a Class A and Class B rating should be a requirement of the development permit. It is recognized that wholesale changes to existing roofing materials within high risk areas of the District are not practical, therefore a long-term replacement standard that is phased in over the roof rotation period would significantly reduce the vulnerability of the community.	See "Other"	The District should begin a process to review and revise existing bylaws and building codes to be consistent with the development of a FireSmart Community. For areas that have been identified as high risk, consideration should be given to the creation of a Wildfire Bylaw that mandates fire-resistant building materials, provides for good access for emergency response, and specifies fuel management on both public and private property in areas of identified high wildfire risk.

	Roofing	Exterior walls	Other
Nelson B.C. Bylaw No. 4247, 2013	<p>ALLOWED</p> <ul style="list-style-type: none"> • Metal Roofing • Asphalt Shingles • Fire Retardant • Wood Shingles & Shakes • Fire Rated Recycled Composite Shingles • Concrete or Ceramic Roof Tiles • Flat Bitumen Based Roofing w/ Aggregate Finish • Screened Soffits <p>NOT PERMITTED</p> <ul style="list-style-type: none"> • Untreated Wood Shingles or Shakes • Open Soffits 	<p>ALLOWED</p> <p>Masonry: Stone & Brick Stucco Fibre-Cement Boards (HardiPlank™) Concrete Block Pre-finished Metal sheeting</p> <p>NOT PERMITTED</p> <p>Wood Siding Shingles or Shakes</p>	<p>WINDOWS ENCOURAGED Double Pane Glass & Tempered Glass</p> <p>DISCOURAGED Single Pane Glass</p>

	Roofing	Exterior walls	Other
North Vancouver B.C. Bylaw No. 6300, 2011	Fire-retardant roofing materials should be used, and asphalt or metal roofing should be given preference.	Exterior walls should be sheathed with fire-resistive materials.	Decks, porches and balconies should be sheathed with fire-resistive materials. All eaves, attics, roof vents and openings under floors should be screened to prevent the accumulation of combustible material, using 3mm, non combustible wire mesh, and vent assemblies should use fire shutters or baffles. Fire-resistive decking materials, such as solid composite decking materials or fire-resistive treated wood, should be used. All windows should be tempered or double glazed to reduce heat and protect against wind and debris that can break windows. All chimneys and wood-burning appliances should have approved spark arrestors. Building design and construction should generally be consistent with the highest current wildfire protection standards published by the National Fire Protection Association or any similar, successor or replacement body that may exist from time to time. All new hydro servicing that is in, or within 10 metres of, a wildfire risk area should be underground, or where this is not feasible, poles of non-combustible materials should be used.
Prince George B.C. Bylaw No. 7850, 2007	Fire-resistant roofing materials (Class A or B) such as metal, clay tile, asphalt shingles and treated wooden shingles should be used on all buildings and structures.	Fire-resistant exterior wall materials such as stucco, metal, brick, rock, and concrete should be used on all buildings and structures. Logs and heavy timbers, although less effective, are also permitted.	Roof vents should be closed in and screened. Decks, porches and balconies should be sheathed with fire-resistant materials. Chimneys should have approved spark arrestors.
Radium Hot Springs B.C. Bylaw No. 396, 2013	Prohibit the use of wood shakes as a roofing material and limit the use of fire-retardant treated wood shingles.	See "Other"	Use recognized standards in the assessment of wildfire hazards (currently 'FireSmart' standards based on NFPA documentation).

	Roofing	Exterior walls	Other
Rural Saanich B.C. Bylaw No. 8940, 2008	All roofing material and insulation requirements must meet the Class B fire-rating requirements contained within the current B.C. Building Code.	See "Other"	Building design and construction shall generally be consistent with the standards in the National Fire Protection Association (NFPA) Standard 1144 – Standard for Protection of Life and Property from Wildfire. All eaves and attic vents shall be screened using 3 mm non-combustible wire mesh at a minimum to prevent the entry and accumulation of combustible materials and windblown embers.
Rural Vernon B.C. Bylaw No. 3387, 2007	Roof coverings on every building must have a Class C fire-resistance classification, determined in accordance with the B.C. Building Code.	Absent	Each development permit issued to authorize the construction of a building in the development permit area shall bear a notation indicating that additional information on the protection of development from wildfire hazard conditions is available in the "Home Owners Fire Smart Manual" provided by the Forest Protection Branch of the BC Forest Service.
Summerland B.C. Bylaw No. 2000-310	All exterior roofs must be constructed of fire-resistant materials that meet a Class A, B, or C rating, excluding wood, wooden shake and shingle products, as defined in the Building Code and FireSmart.	All exposed, combustible structural elements on the exterior of any building must be of a heavy timber construction as defined by the Building Code. Any exposed surfaces, including walls and decks, that are not of heavy timber construction or which are not of non-combustible materials must use fire-resistant materials.	All soffits must be of non-combustible materials. Window panes should be of thermal, tempered glass. All chimney outlets shall be 0.6 meters higher than any part of the roof that is within 3.0 meters. All wood-burning appliances shall require the installation of a spark arrestor. All screening for attic and basement vents for all buildings must be metal and of small enough openings to prevent sparks from passing into the building. Shutters, awnings and exterior walls must be made or constructed from fire-resistant materials. All crawl spaces, the underside of porches and decks, and any sheds must be sealed. Balconies, patios and decks must be constructed from fire-resistant or noncombustive materials. All buildings must contain an automatic fire-sprinkling system that is approved by a registered professional with a specialty in fire suppression design.

	Roofing	Exterior walls	Other
Swan Hills Alberta Bylaw No. 15, 2012	The Town requires that roofing on all structures be ULC (Underwriter Laboratory of Canada) fire-rated.	Absent	Every residence is required to have its house number clearly displayed near the front door entrance and easily visible from the street.
Williams Lake B.C. Bylaw No. 2140, 2011	The roof covering shall conform to Class A, B or C fire-resistance as defined in the B.C. Building Code.	Any material used for exterior wall finishes should be fire-resistant such as stucco, metal siding, brick, cement shingles, concrete block, poured concrete, rock and logs or heavy timbers as defined in the B.C. Building Code.	<p>Chimneys should have spark arrestors made of 12 gauge (or better) welded or woven wire mesh with mesh openings of less than 12 millimetres.</p> <p>All eaves, attic and under floor openings should be screened with corrosion-resistant, minimum 3-millimetre noncombustible wire mesh.</p> <p>All windows must be double paned or tempered.</p> <p>Decks should be constructed of heavy timber as defined in the B.C. Building Code, or, with 1-hour fire-resistant rated assemblies or non-combustible construction as defined by the B.C. Building Code.</p> <p>Manufactured homes should be skirted with a fire-resistant material as outlined in the previous guideline for exterior wall finishes.</p>

Appendix II: Local building siting and landscape regulations

	Priority zones	Other
Campbell River B.C. Bylaw No. 3475, 2012	A report, prepared by a Registered Professional Biologist is required with recommendations for minimizing interface fire hazard in a manner that seeks to preserve, where possible, sensitive ecosystems that may occur in close proximity to development. Registration of a restrictive covenant that prohibits any outdoor burning may be required.	The development of a trail system is encouraged around developments that can accommodate fire vehicle access for fighting wildfire in interface areas. Development shall incorporate fire breaks adjacent to residential areas. These may be in the form of cleared parkland, roads or trails.
Greater Bragg Creek Alberta Proposed: Jan 2012	<p>Zone 1-2 vegetation management is necessary for a large proportion of the structures in the project area and is the responsibility of residents, business owners, and facility operators. Vegetation management required includes:</p> <ul style="list-style-type: none"> • Removal of flammable forest vegetation within 10 metres of structures. • Removal of all coniferous ladder fuels (limbs) to a minimum height of 2 metres from ground level on residual overstory trees. • Removal of all dead and down forest vegetation from the forest floor. • Increased maintenance to ensure that all combustible needles, leaves, and native grass are removed from on and around structures. • Establishment and maintenance of a non-combustible surface cover around the structure including the use of FireSmart landscaping species. • Removal of all combustible material piles (firewood, lumber, etc.) within 10 metres of the structure. <p>Zone 2-3 vegetation management is the responsibility of municipal and provincial governments, residents and landowners, and business owners/facility operators. All stakeholders should implement fuels reduction based on the priorities identified in this plan.</p> <p>Zone 3 containment areas should be planned with collaboration of all parties in the West Bragg Creek Land Users Group. The responsibility for approval lies with Sustainable Resource Development and the strategy will be implemented jointly by Sustainable Resource Development and Spray Lake Sawmills (1980) Ltd.</p>	<p>Ensure that all fuel modification projects are inspected on a regular basis and maintained as necessary.</p> <p>Detailed fuel modification prescriptions must be developed for each proposed vegetation management project prior to implementation.</p> <p>Rocky View County, along with other municipal governments, and Sustainable Resource Development should investigate the possibility of amending Section 664(3)(b) of the Municipal Government Act to permit fire hazard reduction on environmental reserve lands. Establish and legislate FireSmart access road standards for all new developments to ensure safe ingress and egress routes for residents/public and emergency responders.</p> <p>Ensure that adequate fire suppression water supply is provided for the Hamlet of Bragg Creek and all new developments within Rocky View County. Consideration should be given by RVC to the integration of the existing Elkana Ranch Elbow River water gallery and pumphouse as a water tender fill station.</p>

	Priority zones	Other
<p>Hinton Alberta Proposed: Jan 2011</p>	<p>FireSmart Zone 1 vegetation management options include:</p> <ul style="list-style-type: none"> • Removal of flammable forest vegetation within 10 metres of structures. • Removal of all coniferous ladder fuels (limbs) to a minimum height of 2 metres from ground level on residual overstory trees. • Removal of all dead and down forest vegetation from the forest floor. • Increased maintenance to ensure that all combustible needles, leaves, and native grass are removed from on and around structures. • Establishment and maintenance of a non-combustible surface cover around the structure including the use of FireSmart landscaping species. • Removal of all combustible material piles (firewood, lumber, etc) within 10 metres of the structure. <p>Zone 2-3 vegetation management is the responsibility of the Town of Hinton on MR and ER lands, the Provincial Government (SRD) on Crown lands, and landowners and developers on deeded lands. The goal is to reduce the wildfire intensity and rate of spread as it approaches developed areas.</p> <p>FireSmart Zone 2-3 fuel modification methods can vary from hand-crew to full mechanical operations or prescribed burning and may include a combination of complete fuel removal or fuel reduction including spacing of overstory and/or understory, removal of dead standing and/or laying material, and/or removal of ladder fuels (limbs). Debris disposal methods may include mechanical or hand piling and burning onsite, hauling and disposal offsite, chipping and spreading onsite, chipping and hauling offsite, or mechanical mulching onsite. Although there are presently no studies to indicate the acceptable depth of chips onsite, it is recommended that if this method of debris disposal is used the chips are spread sufficiently to avoid a continuous layer of chip material that may support surface fire or smoldering ground-fire during dry periods.</p>	<p>Absent</p>

	Priority zones	Other
Priority Zones Other Kamloops B.C. Proposed: Jan 2008	<p>Address building construction standards and vegetation management in Priority Zones 1, 2, and 3 where these areas fall within the ownership boundaries.</p> <p>Fuel reduced buffers around individual homes from the house to the property boundary, or 10 m in distance, whichever is the lesser, are maintained. In this respect, fuel reduced shall mean the area may contain natural tree cover in locations approved by the City of Kamloops, but the owner must landscape and maintain the area with the intent of eliminating the accumulation of combustible debris (currently enforced).</p>	<p>Be based on a completed site specific wildfire hazard assessment.</p> <p>Achieve the objective of reducing the Wildland Head Fire Intensity to Intensity Class 3 or less.</p> <p>Incorporate emergency vehicle wildfire access and egress into the lot or community design; in the case of communities, a minimum of two egress and access routes per community.</p> <p>Compliment vegetation management efforts on adjacent public or private lands wherever possible.</p> <p>Include risk reduction mitigations for fire risk to adjacent lands.</p> <p>Maximize healthy tree retention or replacement, while meeting the fire hazard reduction objective.</p> <p>Homeowners will continue to maintain FireSmart standards on their individual lots.</p>
Priority Zones Other Kelowna B.C. Proposed: May 2011	<p><i>Priority Zone 1 – Fuel Free Zone (10 m from buildings)</i></p> <p>A fuel free zone should be created around all homes and outbuildings. The fuel free zone should extend 10 m from the structure, or further if the terrain is sloped. The following guidelines should be considered:</p> <ul style="list-style-type: none"> • There should be enough defensible space to protect buildings from approaching wildfire and to reduce the potential for a building fire spreading to the wildland. • Annual grasses within 10 m of buildings should be mowed to a height of 10 cm or less and watered regularly during the summer months. • Surface litter and downed trees should be removed regularly. • Dead, and dying trees should be removed. • Structures at the top of a slope will need a minimum of 30 m of defensible space. • Vegetation within this zone should be of a fire-resistant species. • Trees within this zone should be pruned to a height of 2 to 3 m and not overhang the house or porch. • Remove all piled debris (firewood, building materials, and other combustible material) outside of the fuel free zone. • Defensible space should be provided by the developer and maintained by the property owner. • Community Strata rules should enforce the maintenance of this zone. 	<p>Keep roofs clean of all combustible material. All flammable trees and shrubs growing within 20 meters of any structures should be removed and replaced with fire-resistant species. the most flammable species include those that accumulate dead foliage and branches and have a high content of oils and resin. Characteristics of fire-resistant species to be replanted include the following:</p> <ul style="list-style-type: none"> • Deciduous species; • Low growing plants; • Plants with thick woody stems; • Plants that accumulate low amounts of dead vegetation; • Plants with low resin content (deciduous species); • Plants that retain high moisture content. <p style="text-align: right;">...continued on next page</p>

	Priority zones	Other
Priority Zones Other Kelowna B.C. Proposed: May 2011 <i>...continued</i>	<p><i>Priority Zone 2 – Fuel Reduction Zone (10 to 30 m from buildings)</i></p> <p>Fuel modification in this zone should include thinning and pruning to create an environment that will not support a high intensity crown fire. A surface fire may occur in this zone but it will be of low intensity and easily suppressed. Guidelines for this zone are as follows:</p> <ul style="list-style-type: none"> • Actions in this zone should be oriented towards fuel reduction rather than removal. • Deciduous composition in the overstory should be promoted (i.e. Deciduous species should not be thinned out). • This zone should be extended as slope increases. The 20 m concentric distance from the boundary with priority zone 1 should be corrected for slope. • Thin trees for two tree lengths from buildings. • Treatments within this zone will include thinning of the canopy, thinning the understory and pruning lower branches. • Leaf trees should be the largest on site and canopy heights should be pruned to a height of 2 to 3 m. • Remove all dead and dying trees. • Dispose of all slash created by treatments through pile and burning or removal from the site. • This zone should be constructed by the developer and maintained by the property owner. • Community strata rules should enforce the maintenance of this zone. <p><i>Priority Zone 3 – Fuel Reduction and Conversion (30 to 100 m from buildings)</i></p> <p>The strategies for this zone are similar to those of priority zone 2 with the distance being slope dependent. This environment should be one that does not support a high-intensity crown fire. A surface fire may occur, but it will be of low intensity and easily extinguished. Vegetation management should concentrate on vegetation conversion and reduction rather than removal. the following are guidelines for this zone:</p> <ul style="list-style-type: none"> • Fuel management in this zone should only be undertaken if there are high hazard levels from heavy continuous fuels and steep topography. • Deciduous species should be promoted. • On sloped terrain, the width of this zone will need to be corrected for slope distance. • Thinning and pruning. • This zone should be constructed by the developer and maintained by the property owner. • Community Strata rules should enforce the maintenance of this zone. 	<p>Propane tanks surrounded by vegetation are potential hazards. Combustion adjacent to these tanks could increase the internal pressure causing the tank to vent through a relief valve. The resulting fire can be one of a high-intensity and with the potential to destroy adjacent buildings. Hence, when positioning tanks, the relief valves should point away from buildings. Faulty relief valves will not allow pressure to discharge resulting in a boiling liquid explosion dangerous to those within 300 m.</p> <p>When designing new developments, particularly those in remote locations some distance from emergency services, some consideration should be given to the installation of underground sprinkler systems. These systems can serve as both a method of irrigation as well as an interface suppression tool. Sprinklers can be located on the rooftops of homes and outbuildings. In the event of a wildfire, the sprinklers would be engaged and would increase the relative humidity around the house as well as increase the fuel moisture content of any fuel adjacent to the home resulting in lower flammability and fire behaviour potential. Rooftop sprinklers are also recommended for homes in the interface that do not have fire-resistant roofing or siding.</p>

	Priority zones	Other
Priority Zones Other Langford B.C. Proposed: 2002	Fuel reduced buffers around individual homes from the house to the property boundary or 10m in distance, whichever is lesser. The area may contain natural tree cover in locations approved by the District of Langford, but the owner must landscape and maintain the area with intent of eliminating the accumulation of combustible debris.	<p>For new developments in high or extreme interface fire hazard areas, council and the approving officer may consider requiring the development of a trail system around developments, which would accommodate fire vehicle access for fighting wildfire in interface areas.</p> <p>In order to ensure the ongoing restriction on wood fuel adjacent to residences (excluding enclosed, covered firewood piles), the approving officer may require a Section 219 covenant requiring property owners to ensure the 10m fuel restriction zone around houses and buildings is maintained and that if they are not maintained, they may be required to pay a rent charge of \$1,000 per year.</p> <p>In designing new subdivisions and neighbourhoods within the high to extreme fire hazard development permit areas, proponents shall consider the incorporation of fire breaks adjacent to residential areas. These may be in the form of cleared parkland, roads, or trails.</p>
Maple Ridge B.C. Proposed: July 2007	Many homes and businesses are built immediately adjacent to the forest edge. In these neighbourhoods, trees and vegetation are often in direct contact with homes. The District should create building set backs with a minimum distance of 10 m when buildings border the forest interface.	Given the wildfire risk profile of the community, an emergency sprinkler kit capable of protecting 30 to 50 homes should be purchased and maintained in the community. Fire rescue personnel, or a designate of the department, should be trained to mobilize and set up the equipment efficiently and effectively during a fire event.
Rural Vernon B.C. Bylaw No. 3387, 2007	<p>The area of the development parcel within 10 metres of any building under construction should be kept free of flammable construction materials and debris.</p> <p>The area of the development parcel within 10 metres of any building should be cleared and kept free of all fallen timber and other dead vegetation, and dead standing timber should be removed from that area.</p> <p>Trees on the development parcel within 10 metres of any building should be limbed to a height of 2 metres above ground level.</p> <p>Vegetation on the development parcel within 30 metres of any building should be thinned to reduce the overall tree crown cover to approximately 3 to 6 metres between crowns if the existing crown cover exceeds that amount.</p>	Absent

	Priority zones	Other
Summerland B.C. Bylaw No. 2000-310	<p>Buffers shall be established in the Wildland/Urban Interface Zone. Buffer requirements for wildfire hazard mitigation will be determined by Priority Zone, as identified by the Wildfire Hazard Assessment.</p> <p>Fuel loads shall be managed in each Priority Zone as prescribed by the Wildfire Hazard Assessment.</p> <p>Branches of coniferous trees shall be pruned to remove ladder fuels.</p> <p>The Wildfire Hazard assessment and associated mitigation requirements shall extend to a minimum of 50.0 meters beyond the boundary of the proposed phase of development under consideration.</p> <p>Only fire-resistant plants (including broadleaf deciduous trees, low shrubs, ground covers and annuals) shall be planted within 5 meters of a building.</p>	<p>All development areas shall have at least two access routes, one that may include a dedicated emergency route, ensuring access for fire and other emergency equipment, as well as evacuation of residents.</p> <p>All non-decayed tree trunks and branches with a diameter greater than ten centimeters that originated from coniferous trees shall be removed from the ground.</p> <p>Accumulations on the ground of small branches and pine needles from coniferous trees shall be removed to prevent the spreading of fire on the ground or up trees. Where retained trees downslope from a building may pose a fire hazard, an increased buffer size or other mitigation measure is required.</p> <p>Where retained trees downslope from a building may pose a fire hazard, an increased buffer size or other mitigation measures are required.</p> <p>Landscape rock, top soil and other such non-flammable material shall be required in place of flammable wood-based chip or mulch for ground cover in flower beds, borders, decorative areas and such other areas that are not lawn, shrub or covered by a hard surface.</p> <p>All lawns shall be irrigated by an underground sprinkling system whose operation is controlled by a timer.</p> <p>Areas that are not lawn or covered by a hard surface shall be predominantly xeriscaped gardens.</p> <p>The ground elevation in the immediate proximity of existing coniferous trees or deciduous trees shall not be altered.</p>

	Priority zones	Other
Swan Hills Alberta Bylaw No. 15, 2012	The Town requires all property owners to undertake vegetation management within 10 metres of a building. This is intended to create a fuel modified area in which flammable vegetation surrounding a building is eliminated or converted to less flammable species. The fuel-free zone is immediately adjacent to a given building and extends outwards in all directions for a minimum of 10 metres, and includes the following practices: Flammable forest vegetation shall be removed; all conifer limbs shall be removed to a minimum height of 2 m from the ground on residual overstory trees; annual grasses shall be mowed to 10 cm or less; and, no combustible material piles (firewood, lumber, etc.) shall be allowed.	Absent
Williams Lake B.C. Bylaw No. 2140, 2012	<p>Landscaping on the property within 10 metres (Priority 1 zone) of a building shall not include coniferous evergreen shrubs such as junipers, mugo pines, or coniferous evergreen hedges. No additional or new coniferous evergreen trees are to be planted within 10 metres of the building.</p> <p>It is not advisable to retain previously existing mature coniferous evergreen trees within 10 metres (Priority 1 zone) of the building. Any coniferous evergreen trees that are to be retained on the property that lie within 10 metres (Priority 1 zone) of the building must:</p> <ul style="list-style-type: none"> • Have limbs pruned such that they are at least 2 metres above the ground. • Be spaced so that they have 3 metres between crowns. (In other words, the tips of the branches of a tree are no closer than 3 metres to the tips of the branches of another). • No limbs should be within 3 metres of the building or attachments such as balconies. <p>Landscaping on the property within 10 metres of a building (Priority 1 zone) shall use only non-combustible landscape mulches.</p>	Absent



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