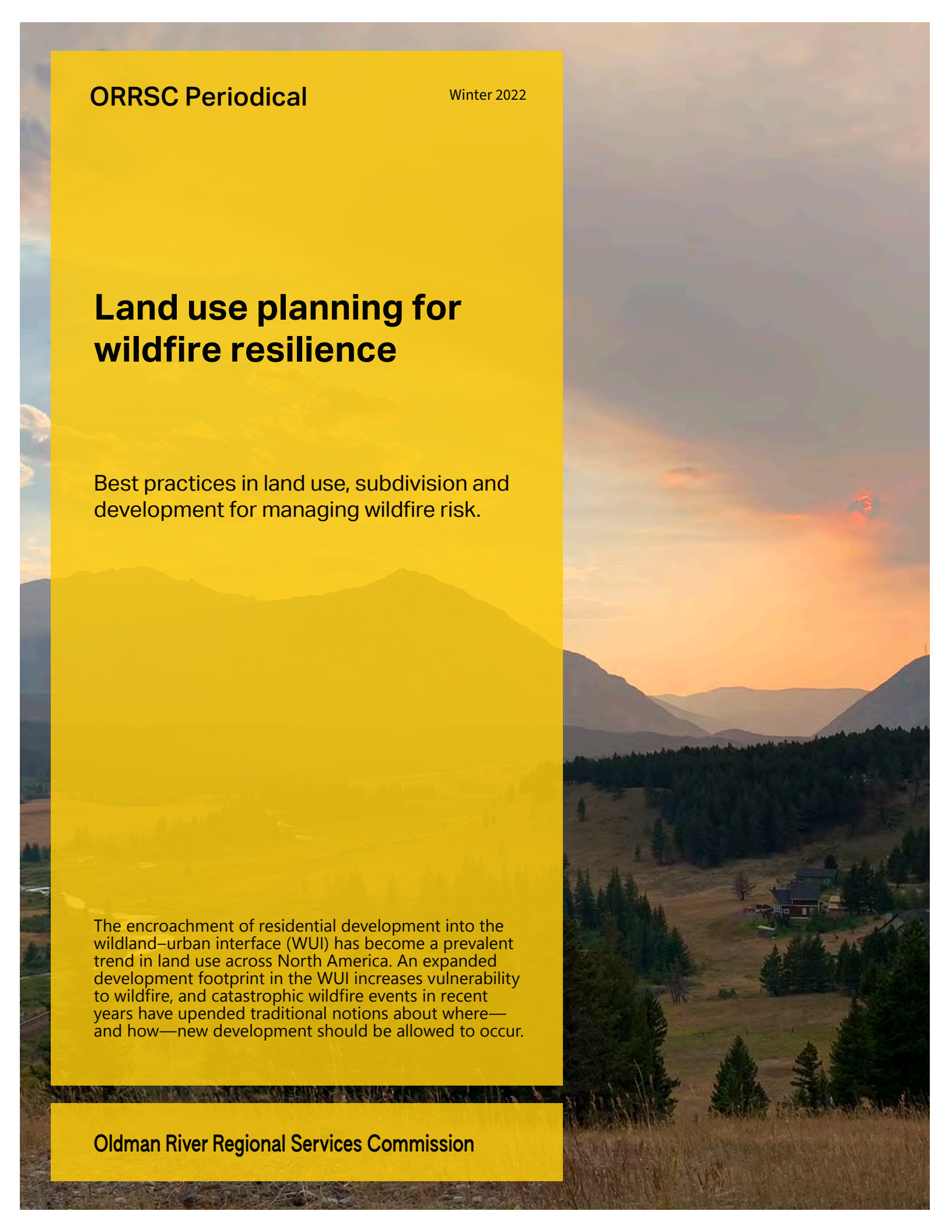


Land use planning for wildfire resilience

Best practices in land use, subdivision and development for managing wildfire risk.

The encroachment of residential development into the wildland–urban interface (WUI) has become a prevalent trend in land use across North America. An expanded development footprint in the WUI increases vulnerability to wildfire, and catastrophic wildfire events in recent years have upended traditional notions about where—and how—new development should be allowed to occur.



Wildfire in the 21st century

Wildfire describes fire that is unplanned or unwanted and that burns in combustible vegetation. Human activity has become the leading cause of wildfire, and also influences naturally occurring wildfire. Historically, the most significant human effects have been the homogenization of forests and widespread attempts to extinguish all wildfire, resulting in the build-up of wildland fuel loads. More recently, altered climate regimes involving less snow pack accumulation in winter and prolonged heat waves in summer have amplified the frequency, intensity and unpredictability of wildfire—a potentially devastating scenario for developed areas in proximity to wild lands. The escalating threat to life and property prompted National Research Council Canada to publish the National guide for wildland–urban interface fires (“the National Guide”), a unifying planning and management framework for local professionals focused on wildfire that has spread into the wildland–urban interface (WUI). It equips land use planners with best practices to enhance wildfire resilience at the site and community scales.

The wildland–urban interface (WUI)

The WUI refers to the area where the built environment abuts or intermingles with wildland vegetation. It is delineated according to topographical features and the relative abundance of combustible land cover classes in proximity to buildings. Typically, these include forest, grassland, shrubland, vegetated wetland, tundra and herb. Earth science researchers have applied various technical thresholds to map the WUI. Depending on the wildland fuel loads, the term “abuts” may indicate a distance of up to 2.4 km, the conventional estimate for the maximum distance a piece of burning wood can be projected in front of a wildfire.

Policy context

Despite the risk associated with developing land in the WUI, high-level model codes and standards are lacking in Canada. Notably, wildfire concerns are not explicitly addressed in the National Building Code or in the National Fire Code. Federal-level involvement has manifested primarily through participation in FireSmart Canada, which has served as the preeminent source of information for landowners and municipalities seeking to proactively manage wildfire risk. FireSmart Canada communicates educational awareness of wildfire and espouses voluntary best practices that reduce vulnerability.

At the site scale, these best practices revolve around the concept of defensible space: the area within the perimeter of a parcel where basic vegetation management strategies are implemented to modify wildland

Alberta’s 21st century wildfires

- 2019 Northwest Alberta
- 2017 Kenow *
- 2016 Horse River **
- 2015 Wabasca/Calling Lake
- 2013 Lodgepole
- 2012 Mackenzie County
- 2011 Slave Lake
- 2008 Newbrook
- 2006 Nordegg
- 2004 Enoch First Nation
- 2003 Lost Creek ***
- 2002 House River/Conklin

* The Kenow Fire burned 38% of Waterton Lakes National Park and also encroached into Cardston County and the MD of Pincher Creek.

** The Horse River Fire was the greatest insured loss event in Canadian history. The event cost \$9 billion, resulted in two fatalities and forced the evacuation of 90,000 people from Fort McMurray.

*** The Lost Creek Fire was fought with shared leadership through a coordinated emergency response team of emergency personnel from Crowsnest Pass and trained volunteers from surrounding municipalities.

FireSmart Canada was previously administered by the Partners in Protection Association. As of 2021, FireSmart Canada is the responsibility of the Canadian Interagency Forest Fire Centre (CIFFC), a non-profit organization operated by the federal, provincial and territorial wildland fire management agencies. Since its inception, FireSmart Canada has demonstrated excellence in cross-jurisdictional collaboration.

FireSmart Canada Structure/Home Ignition Zone



Non-combustible Zone

0–1.5 metres

Zone 1

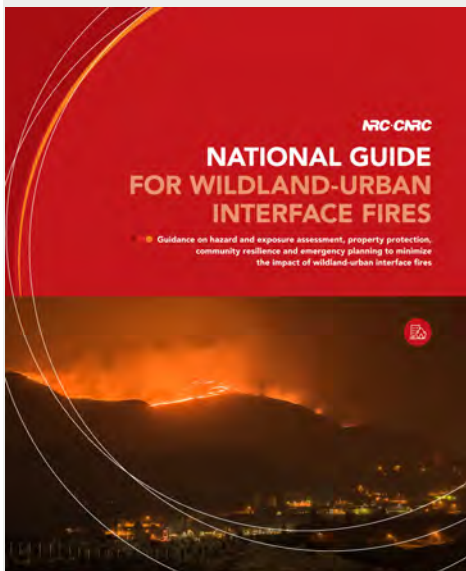
1.5–10 metres

Zone 2

10–30 metres

Zone 3

30–100 metres



[National guide for wildland-urban interface fires](#)



fuel. The Structure Ignition Zone guidelines outline land management strategies for the defensible space at various radii from structures. At the community scale, FireSmart Neighbourhood status can be sought by subdivisions, neighbourhoods or urban municipalities who enlist a WUI specialist to conduct a wildfire hazard assessment and then assemble a committee of landowners, planners and fire professionals to develop and implement a wildfire mitigation plan.

FireSmart Canada programs will be most effective in municipalities that practice robust land use planning. In the US, the National Fire Protection Association (NFPA) guides local planning authorities with its collection of standards dealing with structure ignition hazards and fire protection infrastructure for land development in rural areas. Local authorities in the US also have the benefit of choosing to adopt the International WUI Code developed by the International Code Council. Conversely, a lack of comparable model codes and standards in Canada hinders the capacity for local authorities to plan for wildfire resilience. This is precisely why, in June 2021, National Research Council Canada published the National Guide. The document integrates wildfire hazard and exposure assessment, property protection and emergency planning with land use policy and development regulation. Its interdisciplinary technical committee leveraged numerous existing international codes, standards and guidelines—including those of FireSmart Canada. Notably, the latter's nomenclature was carried forward with respect to the structure ignition zones. The authors of the National Guide maintain that, while the recommendations outlined in the document were not subjected to the level of rigour involved in Canada's code development process, they are intended to eventually be considered for code provisions.

Regional planning

The absence of community-scale WUI maps hinders the ability of municipal planners to implement wildfire resilience strategies. This deficiency could potentially be resolved through regional planning, as the wildfire risk to communities is a top management priority in the South Saskatchewan Regional Plan. To this end, the forthcoming 10-year review of the regional plan by the Government of Alberta should acknowledge the need to undertake region-wide WUI mapping.

Brought into force in 2014, the regional plan also could not have predicted the proliferation of localized solar energy development that has become a mainstay of the broader transition to an economy powered by clean fuels. Because the electricity generated from solar energy at the micro-generation and small scale generation scales is low-voltage, it is able to bypass transmission facilities and feed directly into the electric distribution grid. This is significant because the transmission of electricity through wild lands is among the leading causes of wildfire in North America. A decentralized grid is thus a more wildfire-resilient

grid, and a community's strategies for advancing its energy security are likely to reduce the probability of large-landscape wildfires as well.

Land use planning

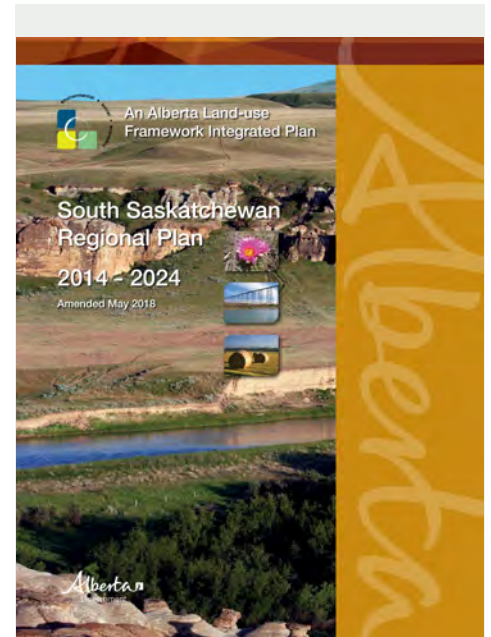
The most effective way to manage wildfire risk is to avoid developing in the WUI altogether. Naturally, prohibiting the development of buildings in the WUI is a tough sell politically, especially for communities in mountainous terrain where the supply of developable land is scarce. But from the perspective of maintaining safe communities—one of the municipal purposes specified in s. 3 of the *Municipal Government Act*—a powerful argument can be made for introducing at least some degree of land use control. This perspective is gaining traction, even in jurisdictions where private property rights are deeply entrenched.

In Montana, state legislation requires all locally-adopted growth plans to include an evaluation of wildfire risk. Missoula County is at the forefront of WUI planning in North America, having followed up its growth policy with a wildfire protection plan and a climate change adaptation plan. While these high-level plans are not binding on decision makers, they include considerable WUI-focused policy that paves the way for future regulatory measures.

Subdivision

Where planning authorities approve new development in the WUI, stricter consideration should be given to subdivision design and servicing requirements. Because the probability of structure-to-structure ignitions is predicated on the configuration of built form in the community, the provision of open space plays an important role in buffering adjacent development. Potentially, the WUI could be listed in s. 664(1) of the *Municipal Government Act* as an eligible natural feature for the purpose of taking environmental reserve. In order to preserve a developable area on the parcel, a threshold could be specified as a percentage of gross parcel area for the maximum amount of WUI land that could be made subject to dedication.

Where environmental reserve is provided for the purposes authorized in s. 664(1), the open space can contribute to wildfire-resilient subdivision design. Of course, open space will only be an effective buffer if the vegetative fuels are managed on an ongoing basis. Engaging community associations is thus an important part of the subdivision planning process, as these groups may unknowingly impose controls that undermine wildfire resilience. The conservation design principles espoused by Randell Arendt—clustered building sites surrounded by ample open space—are more likely to be wildfire-resilient than



SSRP Strategy 1.16

Incorporate wildfire management planning into forest management initiatives including the development of landscape wildfire risk assessments, landscape disturbance planning and FireSmart strategies. Forest management activities—such as prescribed burning, thinning and timber harvesting, will support meeting community and landscape-level FireSmart objectives.

Lot owners in Avimor, a master planned community north of Boise, ID, pay a monthly fire impact fee of \$10 that goes toward regional WUI-related land management initiatives. Garnering recognition for its wildfire-resilient subdivision design, the project has also been criticized by existing ratepayers in the nearest municipality, who anticipate the expanded emergency service area will be accompanied by property tax increases.

Adjacent to Banff National Park, the Town of Canmore is a municipality whose geography has forced it to be proactive in managing wildfire risk. The Town's land use bylaw stipulates that the Subdivision Authority may deem an application for subdivision incomplete if not accompanied by a wildfire risk assessment. Where an assessment is required, the recommendations may be attached as conditions of subdivision approval. The land use bylaw also prescribes wildfire-resilient development standards: only non-combustible landscaping materials are permitted within 1.5 m of any habitable building and ULC-rated roofing materials have been required since 1999. The bylaw currently in force requires a minimum Class B fire rating. The Town's review of its wildfire mitigation strategy in 2018 emphasized the need to replace combustible wood-shake roofing on all municipally-owned critical infrastructure to better align with the best practices required for new development. The review also observed that the effectiveness of emergency response could be strengthened by adding municipal equipment to facilitate quick deployment.

Class A roof coverings are effective against severe fire exposures. Common Class A roof coverings include metal, asphalt shingles, asphalt fiberglass composition shingles, concrete tiles and clay tiles.

Class B roof coverings are effective against moderate fire exposures.

Class C roof coverings are effective against light fire exposures.

conventional subdivision layouts, provided the lots are sized to maintain adequate spacing between the individual residences. The NFPA 1141 standard specifies a minimum separation distance of 30 ft between principal buildings not exceeding two stories or 30 ft in height. The recommended minimum is 50 ft for taller buildings. Where buildings are sprinklered, the distance is 15 ft regardless of the number of stories or building height. The developer should also be required to modify fuel loads on all lots created by the subdivision.

Physical access to buildings in an approved subdivision should be unobstructed and well-marked with signage indicating the civic address and all designated water source locations. Cul-de-sacs, dead-ends and long driveways should be avoided, except where alternate routes are provided for emergency access. Roadways and trails should be sited in a way that maximizes their firebreak potential, and the former should be designed to accommodate emergency access by meeting the minimum dimensional standards required for firefighting equipment. Adequacy of the proposed water supply is just as integral: a best-practices approach acknowledges fire suppression as the chief consideration in sizing a rural water system. The NFPA 1142 standard identifies minimum water supply standards for rural land development for various occupancies and construction classifications. In March 2022, Vulcan County introduced a draft bylaw derived from NFPA 1142 that helps developers of multi-lot subdivisions meet rural fire protection needs through the proper location and construction of fire suppression facilities.

Development

At the site level, the management of on-site fuels may be regulated through land use bylaw standards dealing with such elements as ground cover, vegetation type, fire pits and propane tanks. Provisions related to vegetation should be drafted in a way that affirms their paramountcy over minimum landscaping requirements in the event an inconsistency arises. With respect to buildings constructed in the WUI, ignition-resistant materials should be integrated to safeguard individual structures as well as to minimize the probability of contributing additional fuel loads to a wildfire.

Montana and Utah are among the four US states that have adopted the International WUI Code to bridge the gap between building code regulations and fire code regulations by prescribing standards specific to the WUI. In comparison, local planning authorities in Alberta may be restricted by s. 66(1) of the *Safety Codes Act*, which renders inoperative any municipal bylaw provision purporting to regulate something already dealt with under that Act. Building and fire code regulations currently in force under the *Safety Codes Act* do not account for the WUI. This begs the question of whether, in the interest of protecting life and property, local planning authorities may prescribe more rigorous building

standards in the WUI? Either way, the implementation of wildfire-safe development practices in high-risk communities is likely to be catalyzed by insurance companies. The Fire Underwriters Survey has established a new grading system specific to wildfire that insurers are increasingly relying on to influence policy rates.

Planning departments can promote best practices by distributing itemized lists of ignition-resistant building materials at the pre-application stage. Emphasis should be placed on the building components most vulnerable to wildfire: decks, roofs, eaves, vents and openings. Accessory buildings warrant equivalent treatment to principal buildings given that the former frequently house flammable liquids. Importantly, the American Planning Association stresses that wildfire risk reduction goals need to be considered within the broader objective of reducing greenhouse gas emissions. For instance, concrete made from Portland cement is a material ideally suited to resist ignition but its production comes at a high environmental cost. A more sustainable substitute with an excellent fire rating is cement derived from magnesium oxide, which undergoes thermal treatment at a significantly lower temperature and emits less carbon into the atmosphere. MgO Systems, a construction company headquartered in Rocky View County, has pioneered a revival of this ancient building material, making waves in the industry with its engineered wall panels that utilize magnesium oxide board in lieu of oriented strand board.

Concluding remarks

Recurring wildfires have become the norm, throughout North America and across the globe. National Research Council Canada foresees wildfire becoming more frequent, more intense and more widespread—even impacting regions without a history of wildfire. Because these outcomes are directly related to climate change, locally developed solutions to enhance wildfire resilience might fit within broader frameworks for climate adaptation that are eligible for government grant funding. The Climate Resilience Capacity Building Program is one example of a program offering financial support for climate resilience activities directly controlled or influenced by a community. The program is currently open and is accepting applications until March 31, 2023.

Municipal approaches to managing wildfire risk will vary based on geography and other factors. In all cases, managing this risk is a shared responsibility that will require collaboration across jurisdictions and disciplines—beginning with comprehensive WUI mapping, which was identified by the Canadian Council of Forest Ministers in 2005 as a critical priority for fire research. Land use planning will play a pivotal role in this coordinated effort, as local decision makers are increasingly obliged to evaluate the wildfire risk to communities.

The [FireSmart Interpretive Trail](#) in the Regional Municipality of Wood Buffalo is an interactive public park providing residents with numerous examples of FireSmart best practices.



Bark mulch landscaping is a combustible material that ought to be avoided within the FireSmart non-combustible structure ignition zone.

For more information on this topic contact admin@orrsc.com or visit our website at orrsc.com.

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