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**Northern Forestry Centre**  
Edmonton, Alberta

## **Understanding incentives and barriers to homeowners' uptake of FireSmart<sup>®</sup> Canada's recommended activities for wildfire mitigation in the Urban Service Area of Fort McMurray, Regional Municipality of Wood Buffalo, Alberta**

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A report submitted to FireSmart<sup>®</sup> Canada and the Regional Municipality of Wood Buffalo



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# Executive summary

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This report presents the results of a survey that was undertaken to examine homeowners' FireSmart mitigation practices and investigate existing incentives and barriers to uptake of FireSmart Canada's recommended wildfire mitigation activities in the Urban Service Area of Fort McMurray. Single-family residential property owners, the large majority of whom were affected by the Horse River wildfire, were invited to complete a survey. A total of 496 survey were completed online by these homeowners, with a response rate of 38%.

## Key findings

- The majority of participants were evacuated, but few experienced home loss or property damage.
- Most of the participants generally perceive a low to moderate wildfire risk to their properties: they felt there was a low chance of a catastrophic fire happening soon and/or 'enough' had already been done to reduce the immediate risk.
- A few participants felt they lived in an area at extremely high risk to wildfires and felt risk reduction efforts were futile
- Concerns about wildfires were the same for long time residents and newcomers alike.
- Female participants tended to have slightly higher risk perceptions compared to their male counterparts.
- About half of the participants searched for information about FireSmart. Only 1/3 of the participants looked at or read any of the FireSmart manuals.
- Having information or knowledge of FireSmart did not translate into substantial adoption of recommended mitigation actions.
- About half of the participants believe their house is FireSmart, most of the other participants were unsure.
- Participants preferred and implemented more of the low-cost, low effort mitigation measures
- The least popular involved the cutting of trees although the majority of participants were still doing it.
- Participants felt conducting mitigation activities would make firefighters' jobs easier.
- Asphalt shingles and vinyl siding were present on the majority of homes. This was not a choice, but was provided by the builder or on the home when it was purchased.
- Very few were willing to replace their sidings - cost was the single biggest factor.
- Some participants felt the municipality should focus on city level mitigation activities.

- Several participants felt their neighbours were not as proactive and expressed their concerns about rental homes and absentee homeowners. This influenced their willingness to undertake mitigation.
- Many of the respondents attributed the responsibility of mitigating wildfire risk on their property to themselves as well as to the municipal and the provincial government.
- Some residents shifted responsibility to the fire management agencies.
- The measure that received the highest level of support were reducing insurance premiums or providing tax breaks for those who complete mitigation activities.
- The majority were not interested in completing a FireSmart assessment of their home and property.
  - They did not consider the threat of wildfire high enough. Other cited reasons included financial and time constraint, not being a priority and a lack of knowledge on how to conduct the assessment by themselves.
- However, more than 3/4 of the participants supported providing free FireSmart home and property assessments to homeowners to identify potential wildfire hazards.
  - The dissonance in these findings could suggest that participants do not see themselves at risk, and only see others as needing help.
- Creating bylaws to force residents to meet FireSmart standards was the least favoured option, as participants felt it infringed on their choice to manage their property how they wanted.
- Introducing requirements for developers to use a fire-rated construction material on new house constructions was popular.
- About 2/3 of the participants supported establishing community clean-up groups to help people prepare their neighborhoods for wildfires.

## Recommendations

- Make fire history maps of the region available to residents on the RMWB website, to show residents they live in an area frequently impacted by wildfire.
- Showcase other communities that have been threatened by large wildfires but where community and homeowner mitigation activities reduced the impact. Documented American examples include Circle Oaks, Napa, California; Thomas Fire, Montecito, California; and High Park Fire, Redstone Canyon, Colorado.
- Consider conducting targeted communication at women or targeted to events where a high proportion of women attend (craft sales, farmers markets, school activities, women-only gyms, etc.) instead of generic 'head of household' campaigns.

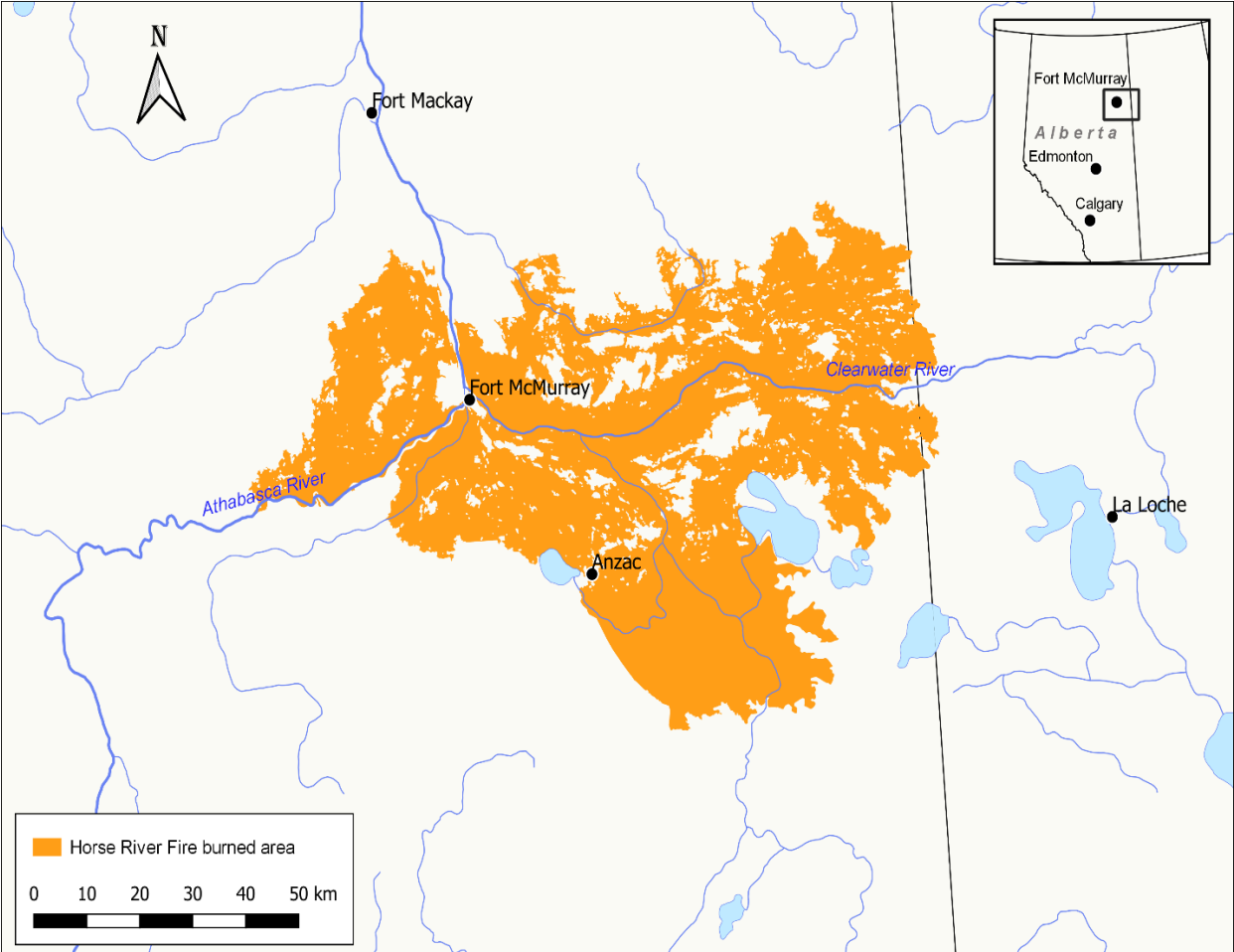
- Provide alternatives for homeowners instead of vegetation removal. FireSmart does not mean vegetation-less. Providing expert advice on the type of trees and vegetation that are FireSmart alternatives during in-person FireSmart home assessments may encourage homeowners who are reluctant to replace higher risk trees on their properties.
- The continued involvement of the local fire department in FireSmart activities, promotional materials, and home assessments could further entrench the fact that conducting these activities is helpful for fire crews, perhaps making it more likely for homeowners to be willing to undertake such measures.
- Homeowners need to perceive that it is worth investing in mitigation actions. This may mean investing resources in communicating about the measure that are most likely to be adopted that will have the largest impact on fire risk reduction.
- It is worth considering whether time or resources should be spent on encouraging or promoting activities that homeowners are unlikely to adopt – often the high cost recommendations like siding replacement - unless some financial incentive can be given.
- All residents who make the effort to participate in a FireSmart home and property assessment should be personally followed up with.
- Staff of the RMWB should be encouraged to spend time and funds to organize and support community FireSmart groups.
- Municipal FireSmart engagement plans should incorporate local expertise.
- Successful wildfire mitigation programs can often be traced to one person - a change agent or “champion” (can be fire chiefs, political leaders, forestry workers or community members). These people should be supported.



# 1. Introduction

The Horse River wildfire of May 2016 was one of the largest wildfire incidents in Canada with wide ranging social, economic and environmental impacts. The fire was first spotted on May 1<sup>st</sup> covering around 2 hectares of land and gradually advanced into the southwest of the urban service area of Fort McMurray. Within three days, aggravated by the prevailing strong wind (43 KM/hr), and an unusual hot season (recorded daily temperature reaching up to 35°C), the wildfire quickly covered thousands of hectares (~ 157,000 ha), jumped the Athabasca River and impacted most parts of the city. More than 88,000 residents of Fort McMurray were forced to evacuate with little notice including the evacuation of First Nation and Métis communities in the Regional Municipality of Wood Buffalo (RMWB). When the wildfire was finally under control by mid June, it had burnt an estimated area of ~ 590,000 ha (Figure 1).

Figure 1: The May 2016 Fort McMurray Horse River Wildfire



The damage from the wildfire was recorded as the costliest insured disaster in recent Canadian history (Mamuji and Rozdilsky 2018). It destroyed more than 2,500 homes and damaged many more dwelling units and business establishments (Government of Alberta 2016; MNP Consulting 2017; KPMG Consulting 2017). Overall, the wildfire resulted in an estimated \$3.6 billion in insurable loss. Commercial and personal damages from the wildfire are estimated to be \$6 billion (Insurance Bureau of Canada 2016).

More than three years after the Horse River wildfire, rebuilding efforts were still ongoing. Along with these efforts, it is crucial to have a good understanding of which mitigation measures homeowners are or are not implementing post-wildfire. The Government of Alberta and the Regional Municipality of Wood Buffalo (RMWB) introduced several wildfire mitigation initiatives targeting communities, businesses and households both before and after the Horse River wildfire. The government of Alberta and the municipality's disaster recovery plans capitalize on the need for wildfire mitigation actions at all levels (homeowners, community, city and municipal) as part of the recovery effort (Government of Alberta 2016; MNP Consulting 2017; KPMG Consulting 2017). The municipality's Recovery Task Force (RTF) envisions making the RMWB a FireSmart focussed region (KPMG Consulting 2017).

The FireSmart program was developed by Partners in Protection, an Alberta-based non-profit organization dedicated to providing information and awareness to reduce wildfire risk in the wildland-urban-interface (Partners in Protection Canada 2018a). Efforts to make Fort McMurray an example of a FireSmart community started as early as 1997 when the Alberta Environment, Land and Forest Service identified Fort McMurray as one of three pilot communities to engage in a multi-faceted interface fire planning process (Partners in Protection Canada 2003). Wildfire risk reduction strategies have been generally guided by the seven disciplines of FireSmart which include education, vegetation management, legislation and planning, development considerations, interagency cooperation, emergency planning, and cross-training (Partners in Protection Canada 2018b). For example, prior to the May 2016 wildfires, the 2010 Wildfire Mitigation Strategy served as a guiding strategy to implement a wide range of wildfire mitigation strategies based on FireSmart principles targeting the Wildland-Urban interface (Walkinshaw 2010). At the individual level, efforts included education and awareness campaigns to encourage homeowners to complete FireSmart activities on their property and around the Home Ignition Zone where the risk can be effectively reduced.

Risk reduction information has been provided by local FireSmart awareness and education campaigns through the media by the municipal fire engagement team, provincial agencies, local fire departments, word of mouth, and a trade fair. FireSmart education and awareness campaigns hope to persuade homeowners that FireSmart activities around properties can significantly reduce vulnerability of homes that may be easily ignited by showers of wind-driven embers from wildland fires. Such efforts have continued post-fire. A study by Westheaver

(2017) following the Horse River wildfire concluded that the vast majority of home losses were due to embers of the forest fire instead of a direct contact by flames. Among the homes which survived the fires, most had completed recommended FireSmart guidelines. Cognizant of this fact, the municipal mitigation strategy developed post fire on December 7, 2017 (Regional Municipality of Wood Buffalo Wildfire Mitigation Strategy) outlined 15 recommendations that were consistent with addressing the seven disciplines of FireSmart (Westheaver 2017).

Despite the fact that the Horse River wildfire removed a large amount of the hazardous wildland fuel surrounding Fort McMurray, wildfire risk to the community remains. Ignitions of wildfire, whether natural or human-caused, can result in a high level of risk as many residents in the city have not implemented FireSmart risk reduction measures (Westheaver 2017). The use of combustible exterior materials (including roofing, siding and decking materials), the existence of combustible materials within 10 metres of structures (including fences and outbuildings), and dense flammable vegetation around homes are identified as being vulnerable to wildfire (Walkinshaw 2017). It was reported homeowners living in some neighborhoods in the city, like Timberlea, Dickensfield, and Thickwood, still have many structures with combustible exterior features (Westheaver 2017). Homeowners have been encouraged to do vegetation management on their property since the fire with the aim of creating a buffer between structures and flammable vegetation.

The Government of Alberta and the Municipality are committed to investing in wildfire risk reduction and encouraging residents to undertake FireSmart activities around their property. However, little information is known about whether homeowners have already or intend to implement FireSmart measures on their property and in their neighborhood during the recovery period. A recent survey completed by RMWB's fire engagement team to assess public awareness of the FireSmart program post fire found low levels of FireSmart implementation among the city's residents (Quinn 2018). Out of the 341 city residents who participated in the survey, only 41% (n=135) said they conducted FireSmart activities on their property, while 46% (n=151) had not made any changes. About 13% (n=44) were unaware of the activities they could undertake (Quinn 2018).

This project examined Fort McMurray homeowners' FireSmart mitigation practices and investigated the incentives and barriers to homeowners' uptake of FireSmart Canada's recommended activities for wildfire mitigation. The study was completed by researchers at Natural Resources Canada, Northern Forestry Centre in Edmonton in collaboration with the Regional Municipality of Wood Buffalo and FireSmart Canada.

## 2. Study Objectives

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### 2.1 Goal

The goal of this study is to examine homeowners' FireSmart mitigation practices and investigate existing incentives and barriers to uptake of FireSmart Canada's recommended activities for wildfire mitigation in Fort McMurray, Alberta.

### 2.2. Specific objectives

- To assess perceptions and attitudes of Fort McMurray residents of wildfire risk and mitigation following the Horse River wildfire.
- To examine the extent to which FireSmart activities are known, understood and applied by homeowners.
- To explore the factors affecting homeowners' uptake of FireSmart Canada

## 3. Methods

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This section outlines the sampling procedure, the construction and implementation of the survey, as well as data analysis techniques employed.

### 3.1. Sample selection

A survey questionnaire was sent to a sample of single-family residential property owners. Based on the most recent (RMWB Municipal Census Report 2018) municipal survey, the total population of RMWB was 111,687, which shows a 10.67% decrease from one year prior to the Horse River wildfire. The decline in the municipal population was attributed to two major factors: the downturn in the region's economy over this period and the Horse River wildfire. Fort McMurray is the city located at the heart of the municipality and classified as an urban service area. The rest of the municipality constitutes nine rural communities and several temporary workers' camps. According to the 2018 municipal census, the Urban Service Area of Fort McMurray has a population size of 75,615 (67.7%). In contrast to the total municipal population, the urban population shows a slight increase up from 66.2% in 2015. Out of the total population in the Urban Service area, 72,056 (95.3%) are permanent residents while 3,559 (4.7%) constitute temporary residents defined as "shadow population". The total number of dwelling units in Fort McMurray in 2018 was 27,072, which showed an 8.4% decrease from the 2015 due to home losses because of the Horse River wildfire. Data on the distribution of occupied dwellings in the city in 2018 showed homeowners residing in a single-detached residential property (also called single-family residential property) continue to be the dominant

form of housing (47.2%) showing a 2.2% increase from 2015. In 2018, more than half of the city's population resided in single-detached dwellings (RMWB Municipal Census Report 2018).

This study focused on homeowners residing in a single-detached residential property. Other residential types were excluded from the sample because they are less likely to complete recommended wildfire mitigation measures, as they are restricted in the types of mitigation activities that could be done on their properties (Faulkner et al. 2009; McFarlane et al. 2011; Nox and Miles 2017).

A random sample of 496 single-detached residential property owners was obtained from the total list of single-detached property owners (N=10,816) in the city. Following statistical sampling theory, a sample of this size is representative of the true population 19 times out of 20 (95% confidence level, +/- 5%). This assumes there is no error from non-response, measurement, or coverage (Dillman et al. 2014).

### 3.2. The survey instrument and data analysis

The survey was administered online. We hired a survey administration company (Advanis) to recruit participants, coordinate and manage the survey. In order to recruit participants, Advanis generated a list of random phone numbers, both landline and mobile, from the local telephone directory. Residents were contacted through a live telephone operator. Potential participants were identified and screened through the operator. Using a pre-defined script, the head of the household was asked questions to determine if the person fulfilled the criteria set. The screening criteria to be included in the study were being a resident of Fort McMurray, owning and living in a single-detached property, and being 18 years of age or older. If the person qualified, the person was asked if s/he would prefer a text message or an email with the link to the online survey. This helped to ensure the participant could fill out the survey at their convenience, whether on their smartphone, tablet, or computer. A toll-free phone number was provided for questions, comments and/or concerns participants may have had regarding the survey. This toll-free phone number went to a voicemail, where participants could leave questions and contact details. Recruitment of participants continued until the desired sample size was completed. There were 24,966 phone numbers dialed in total out of which 5402 were landlines and 19564 were wireless. A total of 1288 was found to satisfy the recruitment criteria. Out of these, 496 homeowners successfully completed and submitted the online survey (Table 1).

**Table 1: Phone recruitment of residents to participate in the survey and total study sample**

Number of attempted calls and total completed survey questionnaire	Total	Landlines	Wireless
Total phone number dialed	24966	5402	19564
Recruited	1288	269	1019
Homeowners' who successfully completed the online survey (sample size)	496	126	370

A follow up was made for the recruits that did not respond (this would include leaving a message, email reminder and sending the SMS link to those we received voicemails for). The survey included a wide range of questions organized under topics including risk perception, experience with the May 2016 wildfires, FireSmart mitigation awareness, FireSmart mitigation practices and demographic characteristics. The survey data analysis was conducted using SAS 9.4 and Advanis' online reporting tool.

## 4. Results

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We begin with a discussion of the socio-economic and demographic backgrounds of the participants. We then discuss participants' experiences with the recent wildfire, risk perception, mitigation practices, sense of responsibility, social pressure, and fuel management preferences using descriptive statistics. Factors Influencing the adoption and implementation of FireSmart mitigation activities are further explored and discussed.

It is important to note that participants did not answer all questions in the survey. As well, for some questions, participants were able to select multiple responses.

### 4.1. Socio-economic and demographic background of the participants

All participants were homeowners above the age of 18 and currently living in the urban service area of Fort McMurray. Men and women were more or less equally represented in the sample, as 49.6% of the participants were female, 48.1% male and 0.4% had other responses<sup>1</sup>. Forty-six percent (46%) were between the ages of 25-44; 45% were between the ages of 45-64 and 7% were above 65 age (Table 2). Participants under the age of 25 constitute only 0.6% (3 participants) of the sample. Thirty-eight percent (38%) obtained a university degree/diploma (38%), a college or trade certificate (37%), some form of post-secondary education (12%) and high school complete (12%). Only 1% of the participants reported having some grade school or high school education. Sixty-four percent (64%) of the participants stated they were employed full-time, 7% were in part-time paid employment, and 12% stated they are retired. Eight percent (8%) stated that they are self-employed, while 7% stated that they have domestic parenting duties. Only 4% stated they are unemployed. Seventy percent (70%) earned a total household income of more than \$120,000 (Table 2). The income distribution data appears to be more or less in line with Statistics Canada census data. The 2016 Census, more than 75% of private households in RMWB earn a total annual income of \$100,000 CAD and over (statistics Canada Census 2019).

Table 2: Background of the participants

Background of the participants	Frequency	Percentage
<b>Gender N=480</b>		
Male	244	49.6
Female	236	48.1
Other	2	0.4
<b>Age groups N=465</b>		
<25	3	0.65
25-34	70	15

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<sup>1</sup> Not all respondents answered every question; N for individual questions may not be 496 total respondents.

35-44	146	31.4
45-54	130	27.9
55-64	81	17.4
65-74	32	6.8
>75	3	0.6
<b>Education N= 487</b>		
Some grade school or high school education	5	1
High school graduate	59	12.1
Some post-secondary education	57	11.7
College or trades certificate or diploma	180	36.9
University or post-graduate certificate, diploma or degree	186	38.2
<b>Employment status N= 496</b>		
Full-time paid employment	317	64
Part-time paid employment	34	7
Self-employed	39	8
Unemployed	20	4
Retired	59	12
Domestic parenting duties	35	7
<b>Household Income N= 441</b>		
Less than \$ 40,000	11	2.5
\$40,001 - \$60,000	13	3
\$60,001 - \$80,000	12	2.7
\$80,001 - \$100,000	34	7.7
\$100,001-\$120,000	56	12.7
More than \$120,000	315	71.4

Participants had lived on their property and in Fort McMurray for varying periods of time, with many being long-term residents (Table 3). The majority (73%) of the participants reported living in the city for more than 10 years - the average length of residency for all participants was 16 years. Only 3% reported living in the city for less than 5 years. In terms of length of residency in their current home, 40% of the participants lived on their property between 6 to 10 years, 26% lived 11 to 20 years, and 14% lived for more than 20 years. The remaining 21% lived on their property for less than five years (Table 3). The average length of participants' residency on their property was 11 years.

**Table 3: Participants' length of residency on their property and in Fort McMurray**

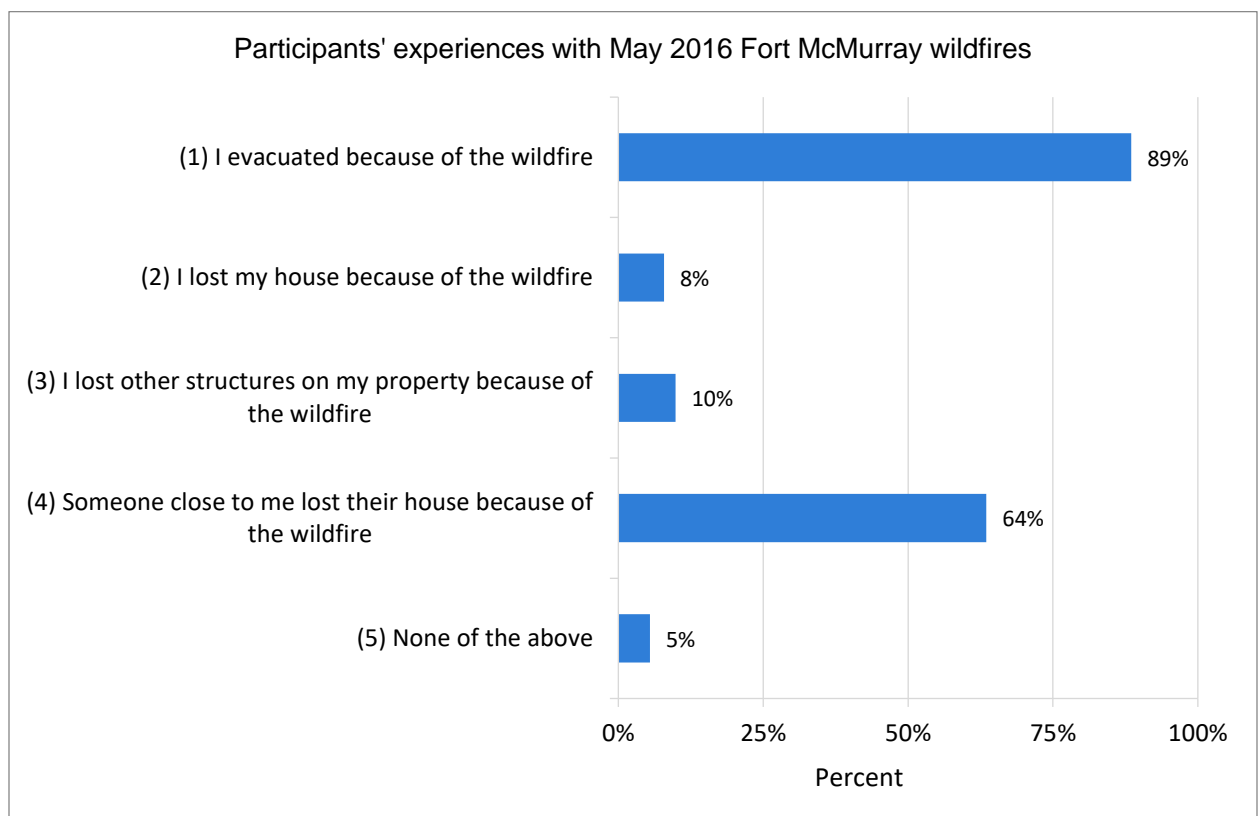
	Length of residency on property N=496	Length of residency in Fort McMurray
Less than 5 years	21%	3%
6 to 10 years	40%	24%
11 to 20 years	26%	41%
More than 20 years	14%	32%



## 4.2. Experience with the Horse River wildfire

The majority of study participants had gone through a direct fire experience during the Horse River wildfire. Eighty-nine percent (89%) of the respondents were evacuated, 8% lost their houses, and 10% reported they had lost other structures on their property because of the wildfire. Even if they had not experienced any property damage due to the wildfires, close to 2/3 of the study participants reported someone close to them lost their house because of the wildfire. Out of the 496 study participants, only 5% reported they did not directly experience the Horse River wildfire (Figure 2).

**Figure 2: Participant homeowners' experiences with the May 2016 Fort McMurray wildfires** (participants were able to select multiple responses)



### 4.3. Perceived Risk

Homeowners’ perceptions of risk from wildfires varied considerably depending on the nature of risk, the experience they had with the recent wildfire, and how they perceived the likelihood of the wildfire threat to their property and the city’s surroundings (Table 4). We examined the wildfire risk perception of the participants by asking them to rate how much of a risk they believe wildfire poses to their property and to the city’s surrounding over the next five years using a scale of no risk (1) to great risk (7). We found the majority of the participants rated the risk to their property over the next five years as low to moderate (mean=3.3). In contrast, they perceived the risk to the city and the surrounding environment as moderate (mean 4.1), indicating many believe there is a higher chance a wildfire would pose a risk to the city than to their individual property.

Table 4: Perception of wildfire risk

Perception of risk variables	Mean	Standard deviation
<sup>a</sup> How likely is it you will experience damage to your property from wildfires within in the next 5 years	3.3	1.6
<sup>b</sup> How likely is it there will be a wildfire near by/in surrounding city’s environ within the next 5 years	4.1	1.5
<sup>c</sup> How controllable are wildfires in terms of people’s ability to control the effects	4.6	1.7
<sup>d</sup> How likely is it firefighters could protect your home if it were threatened by a wildfire	3.7	1.1
<sup>e</sup> Threat is not significant enough to warrant mitigation	2.7	1.0
<sup>f</sup> Wildfires are too destructive to bother preparing for	2.0	0.8

<sup>a&b</sup>Rated on a scale from 1= no risk, 7= very high risk.

<sup>c</sup>Rated on a scale from 1= not at all controllable 7= controllable.

<sup>d</sup>Rated on a scale from 1=very unlikely 5= very likely.

<sup>e&f</sup>Rated on a scale from 1= strongly disagree 5 = agree.

Respondents were also asked about their ability to control the effects of wildfires on a scale of 1 (not at all controllable) to 7 (very controllable). Interestingly, more than half of the participants perceived wildfire as generally controllable (M= 4.6). When respondents were asked, “how likely it is firefighters could protect your home if it were threatened by a wildfire?” about 2/3 of the participants felt it was likely that firefighters could protect their home. Only 13% stated it was unlikely fire fighters could protect their home and 21% stated they were not sure. Although there is a low to moderate level of risk perception to property, many disagreed with the statement that the “threat is not significant enough to warrant mitigation” (mean =2.0). While most respondents (67%) disagreed with the statement “wildfires are too destructive to bother preparing for”, some participants (19%) maintained the view that wildfires are too catastrophic and any FireSmart measures they would perform around their property would do little to protect them from damage. As will be discussed later, such views,

among others, seem to have negatively influenced participants FireSmart mitigation actions around their property.

Further, we also examined if there was a variation in participants' wildfire risk perception by gender, experience with the Horse River wildfire, and length of residence in Fort McMurray. Although the majority of the participants rated the risk to their property over the next five years as low to moderate, we found a slightly higher wildfire risk perception among female participants as compared to their male counterparts (Table 5). However, we found no significant relationship between risk perceptions, experience with the 2016 Fort McMurray wildfire and length of residency in Fort McMurray (Table 5).

**Table 5: Risk perception by gender, wildfire experience and length of residency**

Variables	*Perception of risk to property from wildfires over the next five years		t-value
	Mean	Standard deviation	
Gender			0.007***
Male	3.1	1.5	
Female	3.6	1.6	
Experience with the 2016 Fort McMurray wildfire			0.7
Direct experience* *	3.3	1.5	
No experience	3.4	1.9	
Length of residency			0.1
<10 years	3.5	1.6	
>10 years	3.3	1.6	

\*Rated on a scale from 1= no risk, 7=very high risk.

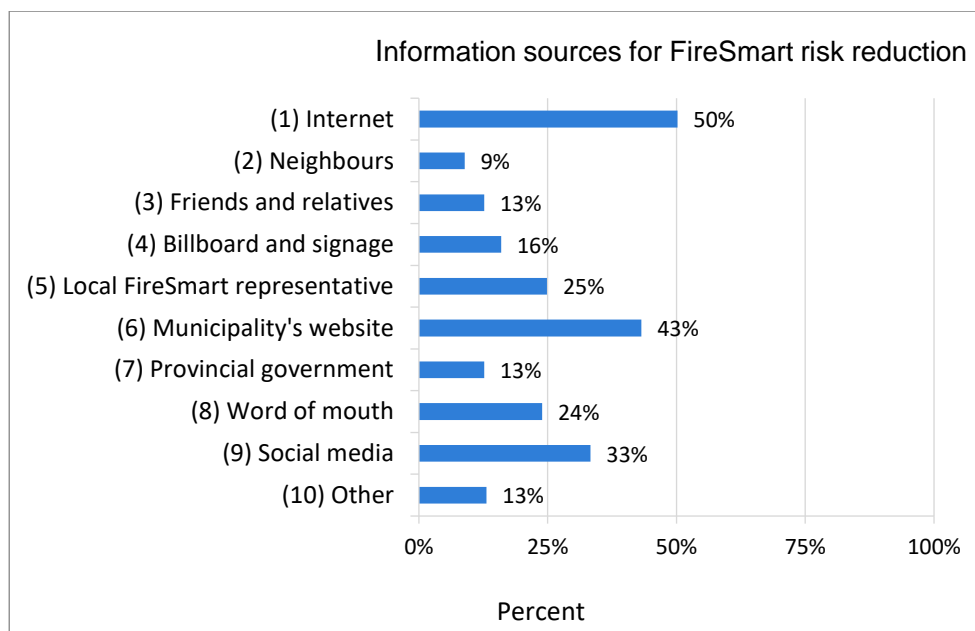
\*\*Direct experience with the fire included those who were evacuated, lost homes or other structures on their property.

\*\*\* Significance is indicated by  $p < .05$

## 4.4. FireSmart mitigation awareness

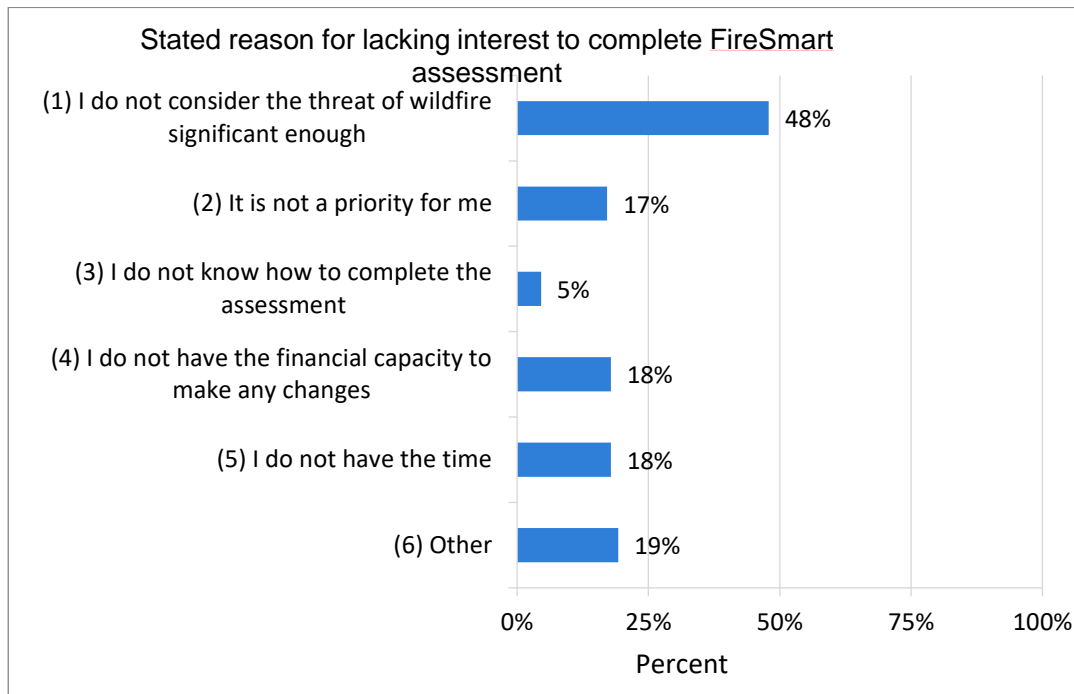
Out of the 496 study participants, 213 (43%) of the respondents indicated they had searched for information about FireSmart to learn about how to reduce wildfire risk around their property. The study participants used a variety of sources. The most common information sources included the internet, the municipality's website, social media, a local FireSmart representative, and word of mouth (Figure 3). Other information sources less frequently used include billboard and signage, provincial government's information sources, friends and relatives, and neighbors.

**Figure 3: Homeowners' sources of information for FireSmart risk reduction** (participants were able to select multiple responses)



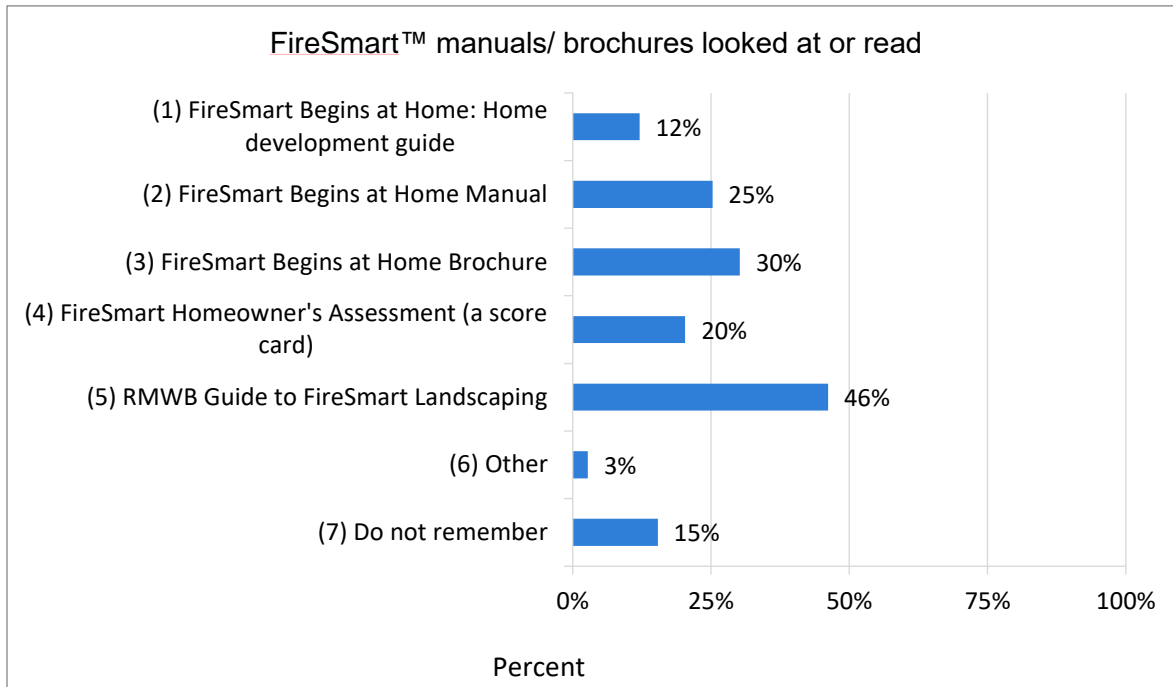
Of the 496 participants, about half (50.4%) felt their house was FireSmart, while nearly 40% of participants were not sure whether their house was FireSmart or not. Only 51 of the participants (10%) believe their house is not FireSmart. Survey respondents were also asked if they had interest in completing a free FireSmart assessment for their property in order to determine the level of wildfire risk and the actions they could make to mitigate the risk: 41.8% said yes and 58.1% said no. The most frequent stated reason for lacking interest in completing a FireSmart assessment was related to having a lower risk perception or not considering the threat of wildfire significant enough to warrant any action. Other stated reasons in order of their importance included lack of finances, time, giving less priority to wildfire mitigation, and a lack of knowledge on how to complete the assessment (see Figure 4).

**Figure 4: Stated reason for lacking interest in completing a FireSmart assessment** (participants were able to select multiple responses)



We also asked if participants have ever read or looked at FireSmart related manuals/guidelines prepared by the municipality, FireSmart Canada, or any other agencies. About 1/3 of the study participants stated they have looked at the FireSmart manuals available online on the Regional Municipality of Wood Buffalo (RMWB) website, the Government of Alberta website, or the FireSmart Canada website. The RMWB website is the most frequently visited (48%) website to access materials, followed by the FireSmart Canada website (20.3%), the Government of Alberta website (7.5%) and other (20.3%). Participants said they have accessed FireSmart related manuals/guides from sources like trade shows, the local fire department, town hall meetings about wildfire mitigation, farmers market and from neighbours. About 15% did not remember where they looked at or read about FireSmart (Figure 5). The most widely viewed product is the RMWB Guide to FireSmart landscaping brochure (46%). Others in order of priority included FireSmart Begins at Home Brochure (30%), FireSmart Begins at Home Manual (25%), FireSmart Homeowner’s Assessment (a score card) (20%), and FireSmart Begins at Home: Home development guide (12%).

Figure 5: FireSmart manuals/brochures looked at or read (participants were able to select multiple responses)



## 4.5. FireSmart mitigation activities known and implemented in post-fire recovery

We also assessed whether homeowners had completed recommended FireSmart mitigation actions after the Horse River wildfire. Following FireSmart Canada’s recommended mitigation activities (first proposed by Partners in Protection (2003), we broadly classified the actions into two broad categories: (1) vegetation management and fuel-reduction activities and (2) structural mitigation measures.

### 4.5.1. Vegetation management and fuel-reduction activities

Vegetation management and fuel-reduction activities constitute several FireSmart mitigation actions homeowners should complete to reduce the risk of wildfire around the area known as the “Home Ignition Zone”. According to FireSmart Canada, this ignition zone includes “the condition of the house and its immediate surroundings within 30 to 100 metres and other structures such as garages, decks, porches, or fences that come in contact with the house” (FireSmart Canada 2019). These activities included vegetation management activities specifically for wildfire risk reduction (such as thinning and removing trees, moving a woodpile, etc.) and other activities completed as part of general property maintenance (such as mowing and watering lawns, removing debris from roofs and gutters). We asked participants whether

they had completed such actions over the last year for reasons that included protecting their home from wildfires. We found that although participants had completed several recommended vegetation management mitigation measures, not all the measures were equally implemented.

From the list of vegetation management measures presented to the participants, the two most widely implemented activities were cleaning up of fallen branches, dry grass and needles from within 10 metres of home (81%) and keeping rain gutters and roof free of leaves, needles, and branches (78%). Sixty (60%) of the participants stated they kept tree limbs pruned at least 2 metres from the ground and spaced trees 3 metres apart. Sixty (60%) of the participants also stated they had moved woodpiles or other combustible materials more than 10 metres from their home. While 56% of the participants stated that they cleared the area within 10 metres of their house of flammable trees, the rest of the participants stated they did not (Table 6). Therefore, the least popular homeowners' vegetation management activities were those that involved cutting trees. However, it is important to note that the majority of participants still undertook these activities.

**Table 6: Percentage of homeowners who had adopted vegetation management and fuel- reduction activities**

<i>Vegetation management and fuel-reduction activities</i>	Yes		No		N=
	Frequency	%	Frequency	%	
In the past year, I have kept my rain gutters and roof free of leaves, needles, and branches <i>for reasons that include protecting my home from wildfires</i>	385	78%	107	22%	492
In the past year, I have cleared the area within 10 metres of my house of flammable trees, other vegetation and combustible materials <i>for reasons that include protecting my home from wildfires.</i>	277	56%	218	44%	495
In the past year, I have kept my tree limbs pruned at least 2 metres from the ground and have spaced my trees 3 metres apart <i>for reasons that include protecting my home from wildfires.</i>	293	60%	203	41%	496
In the past year, I have moved woodpiles or other combustible materials more than 10 metres from my home <i>for reasons that include protecting my home from wildfires.</i>	291	60%	202	40%	493
In the past year, I have cleaned up fallen branches, dry grass and needles from within 10 metres of my home <i>for reasons that include protecting my home from wildfires.</i>	401	81%	94	19%	495
In the past year, I have done something not listed above <i>in order to protect my home from wildfires</i> (Please list other wildfire protection measures you have taken in the past year).	129	26%	363	74%	492

Some participants also reported completing other activities not listed above including removing wooden walkways around the perimeter of the house and replacing it with gravel, replacing and planting less flammable vegetation around the home, landscaping using rocks, and replacing wood decking with composite materials. While most participants completed the vegetation management and fuel-reduction activities to protect their homes from wildfires, other reasons were also mentioned including aesthetic reasons/to make property look nicer, to minimize other risks (e.g., falling trees, flooding), and to increase property value. Participants who have not completed some of the FireSmart recommended mitigation measures had a number of reasons for not doing so despite 41% saying that it was a priority to implement the activities. The most commonly cited reasons for not completing such activities were they required information before they could complete these actions (28%), and they did not consider the threat of wildfire significant enough to warrant doing some of these activities (24%) (Table 7). Importantly, 37% of participants said their family or neighbors would like the changes and 69% felt that completing FireSmart activities would make firefighter’s job easier when responding to future fires.

**Table 7: Attitude towards FireSmart vegetation management and fuel-reduction measures**

	Mean <sup>a</sup>	SD	Agree <sup>b</sup>	Disagree <sup>c</sup>
I need more information before I can complete some of these activities	2.8	0.9	28%	40%
If I made all or some of the suggested changes, my family or neighbors would like it.	3.3	0.8	37%	16%
I do not have the financial capacity to make these changes	2.6	1.1	19%	51%
Implementing these activities is a priority for me	3.3	0.8	41%	16%
For physical reasons I am unable to complete some of these activities without assistance	2.3	1.1	18%	68%
I do not have the skills to complete to complete some of these recommended activities	2.5	1.0	19%	62%
If I made those changes I would not feel as connected to nature	2.4	1.0	16%	62%
I do not consider the threat of wildfire significant enough to warrant doing some of these activities	2.6	1.0	24%	48%
Wildfires are too destructive to bother preparing for	2.0	0.8	8%	80%
If I made these changes, it would make firefighters’ jobs easier when responding to future wildfires	3.7	0.9	69%	10%

<sup>a</sup>1= Rated on a scale from 1= strongly disagree, 5= strongly agree

<sup>b</sup>1&2 on 5-point scale.

<sup>c</sup>4&5 on 5-point scale.

Some of the study participants also mentioned lack of skills (19%), lack of financial capacity (19%), physical inability (18%) and a preference to natural connectedness over tree cutting/vegetation removal (16%). Five of the respondents also mentioned their lots were too small to adhere to some of the recommended measures such as moving woodpiles 10 metres from a house. Still others maintained the view that vegetation removal and tree cutting around



their house would do little in protecting them from approaching wildfires; rather they left this responsibility for the municipality to maintain a firebreak around the city. Respondents were given the opportunity to provide comments in addition to the structured questions and these comments provided additional insights on the respondents' views and opinions towards FireSmart recommended mitigation measures. Table 8 below summarizes the comments thematically and using direct quotes.

**Table 8: Homeowners' opinions towards FireSmart recommended vegetation management measures on their private property in Fort McMurray**

<b>Main Themes</b>	
Preference for natural connectedness or forest/tree scenic values	<p><i>"I'm pro safety but also pro freedom. We purchase homes in certain areas for multiple reasons, for example along the trail system or forest. Obviously, there's more risk along the forest and we knowingly take that risk and pay more for that luxury [...] one does not simply rebuild their home or tear down the surrounding forest due to the risk [...] We take WAY bigger risks every day. There are much bigger issues to address in this world than replacing my shingles and moving my woodpile. We live in a remote area surrounding my beautiful nature. Those who are afraid probably should not live in this type of area"</i></p> <p><i>"I have a large tree on my lot that has been a joy for years. Fires happen. They cannot all be prevented. Fires even happen in cement cities. To remove the trees indiscriminately is inexcusable"</i></p>
Having too little space	<p><i>"My home does not have enough space to move things 10 metres away (yard is smaller)"</i></p> <p><i>"I clear around my house of combustible materials, but I can not move them more than 10m away due to the size of my yard. I do not have any trees to prune or trim up"</i></p>
A Lack of knowledge/information on the type of trees/vegetation to be planted	<p><i>"Please communicate what types of trees and shrubs would be acceptable under the FireSmart program. I reached a few years ago after the fire and never heard back from anyone. We would like to replant some trees on our property to compensate for the clear cutting that occurred on municipal land in back of our home on the Birchwood trails"</i></p> <p><i>"It would be great to have a guide how to make your house fire smart. Maybe have someone come by and offer suggestions to make the home fire smart"</i></p>
Action would reduce property value	<p><i>"I just want to say that it's a shame that so much trees were cut down because of the fire. I moved to where I am because of being surrounded by trees &amp; nature, which I loved. Enjoyed listening to the birds and seeing woodpeckers every day &amp; don't see them anymore. Why is it that Wood Buffalo area (where properties are an acre in size) can have all kinds of trees in their yards but the rest of us have to be cut back to 30 metres? Not fair. My property has lessened in price substantially because of this. Trees should have been cut back on city perimeter only"</i></p>
Feeling 'optimistic'/under-estimating the risk	<p><i>"More than one way out of town would be a good start. I live in a neighbourhood that is unlikely to be touched by wildfires"</i></p>
Fatalistic view "Wildfires are too catastrophic to bother preparing for"	<p><i>"Embers jumped the mighty Athabasca, intensity of fire created 'The Beast' with its own weather, wind, unpredictability - and to show who's boss. We can only do the best we can, at the end of the day, if nature is pissed off, she'll run over us out here in the middle of nowhere in the Boreal Forest"</i></p> <p><i>"I do not think that an out of control wildfire can be stopped. The beast jumped the Athabaskan River so I highly doubt the firebreaks the city has put so much money into would have much"</i></p>

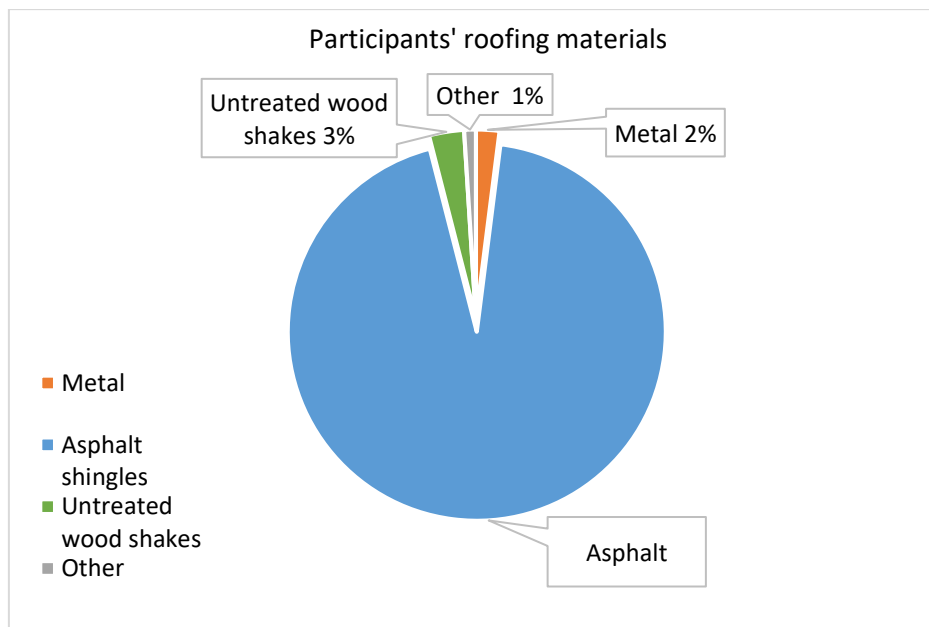
	<p><i>effect. Unless we put a mile wide cement pad all the way around the city and remove all nature, wildfires will always be a part of Fort McMurray life”</i></p> <p><i>“I lost my house and feel that there was not much that could have been done to prevent it”</i></p>
Shifting responsibility away to firefighters/government agencies	<p><i>“I can't fairly deduct how at risk I am for future wildfires. That is mostly to do with the resources Fort McMurray has to fight these fires. Not for one second do I believe my house is still standing because it is fire smart. It is sheer dumb luck and the limited number of first responders and equipment available in Fort McMurray. I honestly and truly blame government for that fire not being extinguished. Nobody outside of Fort McMurray was allowed to help us and it wasn't because residents didn't want it”.</i></p>

## 4.5.2. Structural mitigation measures

### 4.5.2.1 Roofing material

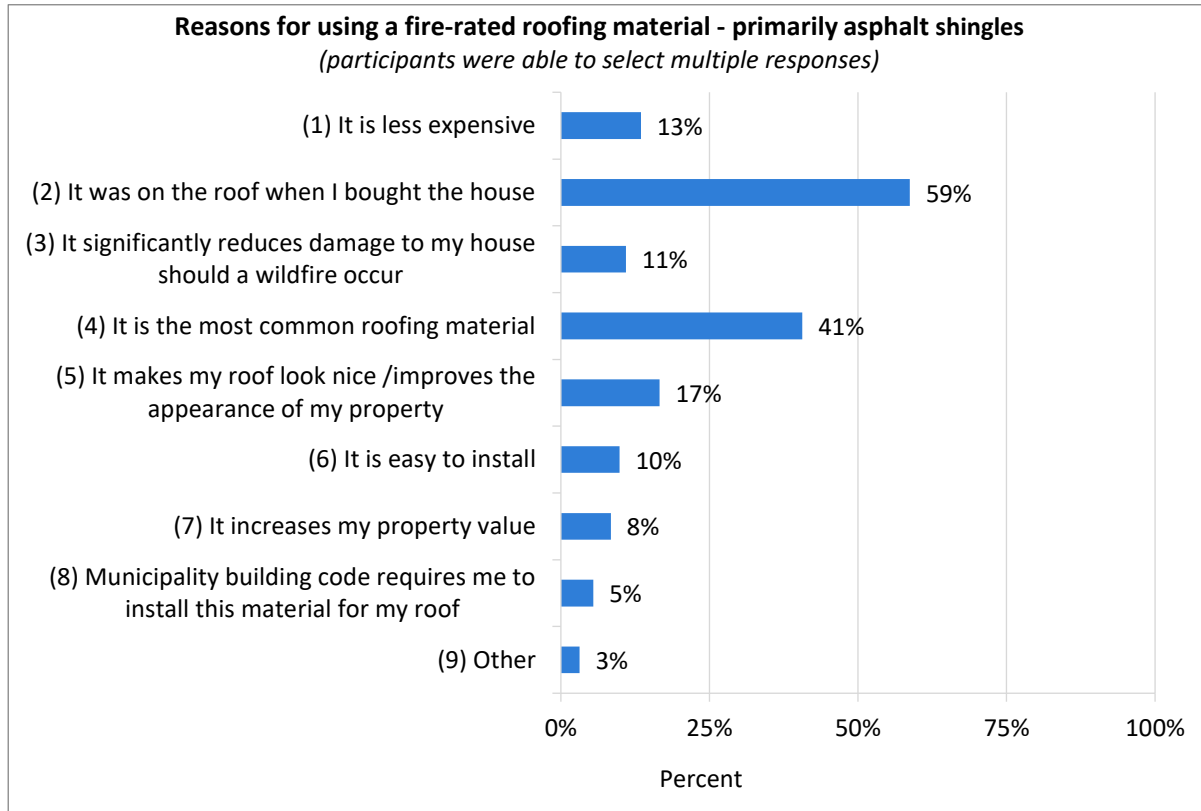
We found an overwhelming majority of the participants have asphalt shingles (94%) and metal roofing (2%) (Figure 6). These are fire-rated roofing material known to offer strong protection to ember fire starts (FireSmart Canada 2019). Only 3% of the participants reported having untreated wood shakes – a roofing material rated as flammable and more vulnerable to sparks and burning embers from a wildfire (FireSmart Canada 2019). The remaining 1% had other materials such as recycled plastic, rubber, and treated wood shakes.

Figure 6: Participants’ roofing materials



The majority (59%) of the participants stated they had asphalt shingles because it was on their roof when they bought their house, and it is the most common roofing material (41%). Some of the other reasons cited included aesthetic reasons or for improving the appearance of a property (17%), it being less expensive (13%) and easy to install (10%) (Figure 7). Only 11% of the participants stated they had asphalt shingles because the shingles could significantly reduce damage to their house should a wildfire occur.

Figure 7: Reasons for using a fire-rated roofing material (participants were able to select multiple responses)

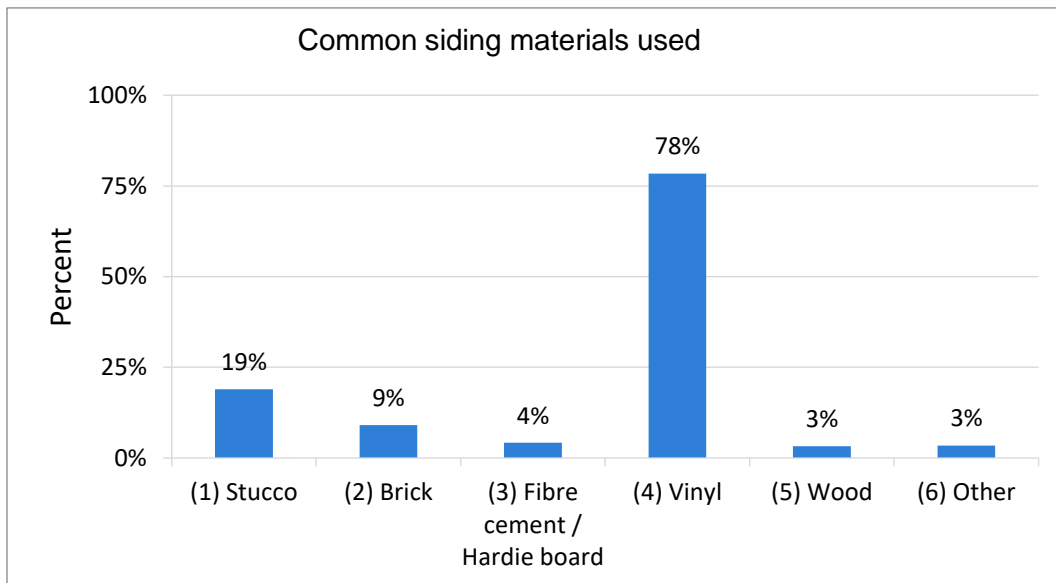


The few survey respondents (19 out of 496) who had not installed a fire-rated roofing material were also asked if they were willing to replacing it with a higher fire-rated material. Of these, only 3 respondents expressed their willingness to replace it with a higher fire-rated material and two of them expected they could make this change within the next five years. The rest of the respondents were either unwilling (7 respondents) or were not yet sure if they needed to replace it or not (9 respondents). Sixteen of the respondents cited lack of financial capacity and not having a plan to replace it unless it gets old and needs repair. Three respondents indicated they did not consider the threat of wildfire significant enough to warrant this change.

#### 4.5.2.2. Siding material

We found the majority of the study participants had vinyl as a siding material (78%) (Figure 8). In particular, vinyl was found to be the most widely used construction material - used either uniformly or in combination with other materials. The use of vinyl siding can decrease the likelihood of a house surviving a wildfire as this material can melt when exposed to high temperatures, allowing the fire to reach the underlying wall components and penetrate the interior of the building (FireSmart Canada 2019). Only a third of the participants reported having siding materials with higher fire resistance including stucco (19%), brick (9%) and fiber cement e.g. Hardie board (4%) (Figure 8). About 3% reported using wood and another 3% had other materials such as aluminum, metal, and cement.

Figure 8: Participants' siding materials



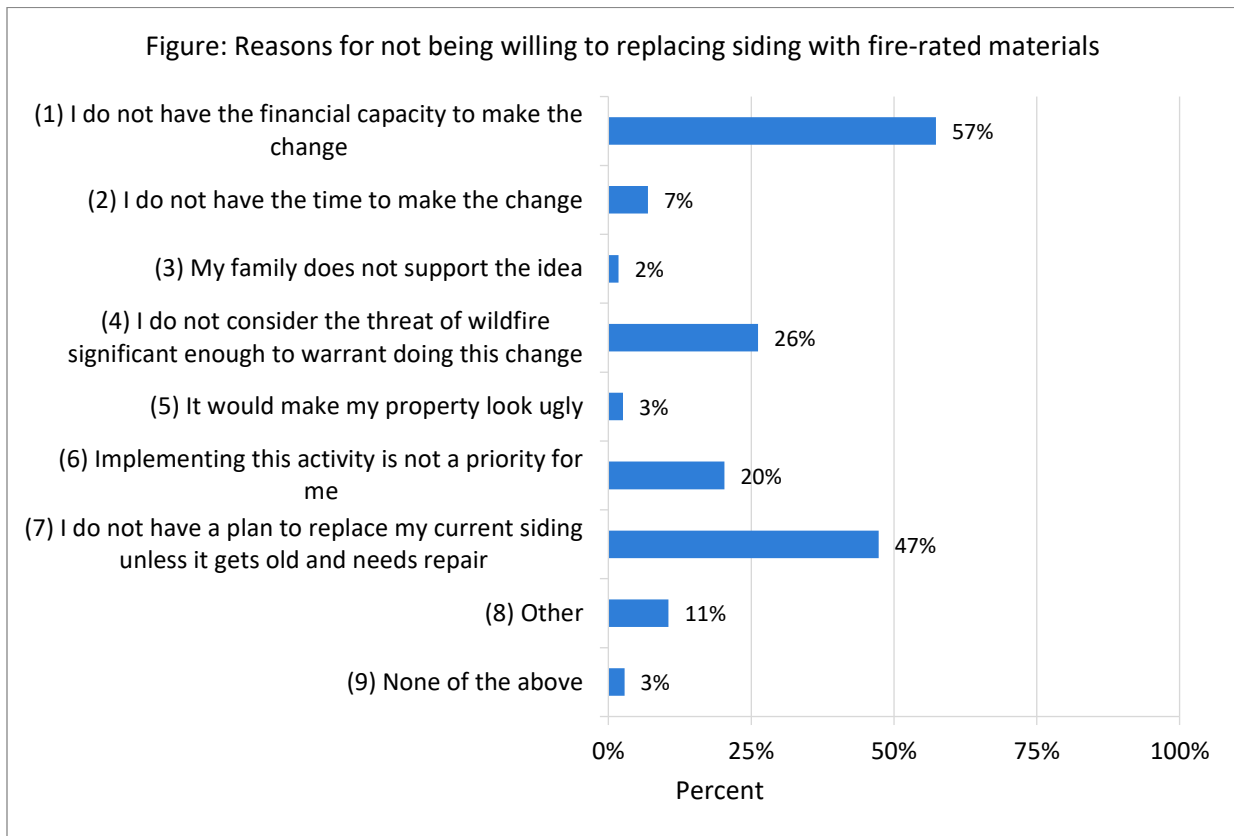
When asked the primary reason for using the siding material currently installed on their homes, the majority (70%) stated it was already in place when they bought the house. Again, of those using a fire-rated siding, only a small number (16%) stated that they used the material for home construction believing it significantly reduced potential damage to their house should a wildfire occur.

Respondents who had lower fire rated siding material like vinyl were also asked if they were willing to replace their siding with more fire-resistant materials (such as stucco, brick, fiber cement boards and/or poured concrete). Of the 389 participants who had vinyl as siding material, more than half (52%) said that they are unwilling to replace their siding, and 25% stated they are not sure; Only 19% (76 respondents) expressed their willingness. The remaining

6% had no opinion. Out of the 76 respondents who were willing, 33% (25 respondents) expect they can make this change within the next five years and 15% were yet unsure.

Respondents who were unwilling to replacing their sidings with a higher fire rated material cited several reasons. Among these, two of the most frequently cited reasons were lack of financial capacity (57%) and not having a plan to replace current siding unless it gets old and needs repair (47%). Interestingly, 26% (102) of the participants stated they do not consider the threat of wildfire significant enough to warrant doing this change. Some of the other cited reasons included that it was not a priority, lack of time, aesthetic reasons and lack of support from family (figure 9).

**Figure 9: Reasons for not being willing to replacing siding with fire-rated materials** (participants were able to select multiple responses).



From those who selected 'other', two of the participants stated they had already spent enough money on their house and were not willing to spend any more money. Another participant mentioned insurance was more complicated when a house was partially damaged as opposed to completely burned down. Another participant stated that he was selling his property soon. Some strongly opposed the idea of making it a requirement for homeowners to make such changes. In the words of some of the participants:

*"I strongly disliked the suggestion of being forced to do anything to my home at my expense. I owned this home before the fire. According to all current and previous laws my home is fine the way it is. I'd leave Fort McMurray if I had to replace my siding for a more "preferable and fire smart exterior". If they want to impose such laws on new builds be my guest"*

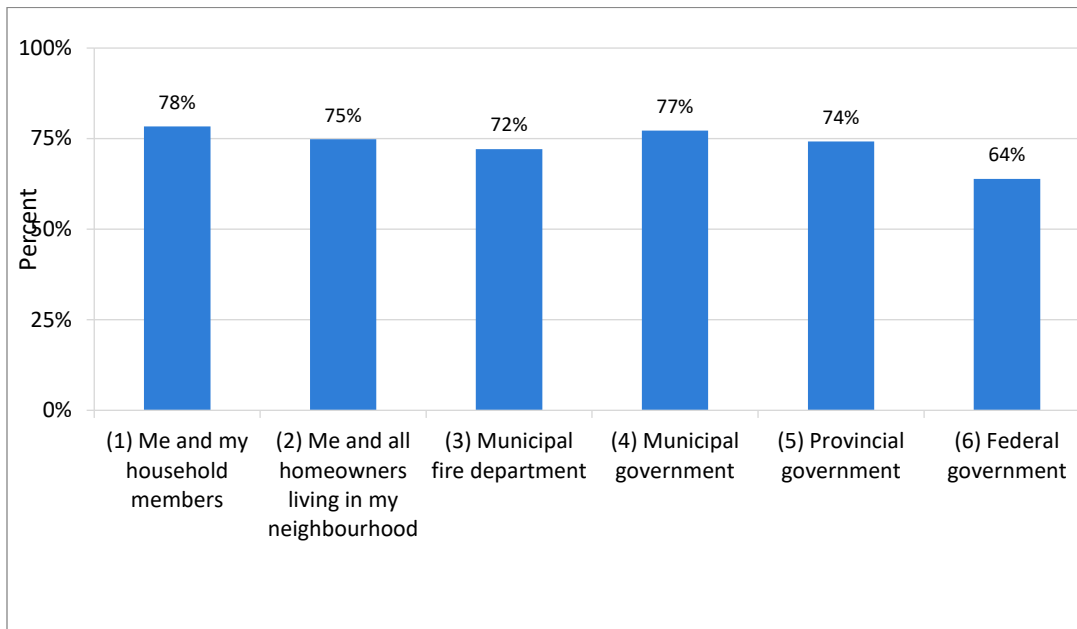
*"If you try to force people to make changes when they can't afford it, you will lose more residents than you already have. People will just leave and put their homes up for sale. The economy is too bad right now to demand anything from taxpayers. We are broke".*

*"Do not force me to spend on a house that is underwater with bank you will put more owners bankrupt".*

## 4.6. Sense of responsibility

Participants were asked whom they thought should be responsible for reducing wildfire risk on their property: themselves and their households, municipal/city fire department, the municipal government, the provincial government, and/or the federal government. A considerable number of respondents attributed responsibility to themselves as well as the government at different levels. Overall, most (78%) of the participants indicated homeowners have responsibility for reducing the risk of wildfires to their properties, followed by the municipal government (77%), themselves and homeowners living in their neighborhood (75%), and the provincial government (74%) (Figure 10). A relatively lower proportion (64%) viewed mitigation as a federal government responsibility.

**Figure 10: Participants’ attribution of responsibilities to wildfire risk reduction activities (participants were able to select multiple responses)**



Some participants were critical about on-going FireSmart activities being completed at the municipal level such as firebreaks and cleaning of vegetation on municipal lands. Table 9 below summarizes some of the views and concerns of the participants towards municipal level FireSmart mitigation activities completed on public lands.

**Table 9: Participants’ views on municipal level FireSmart mitigation activities**

Main Themes	
Priority should be given for vegetation management on municipal lands	<i>“I feel that the 30 m clearing of vegetation on our yard in addition to the existing 40 m clearance beyond our property lines across the firebreak area is sufficient for fire fighting needs. I believe that the removal of dead trees and deadwood in the Birchwood trails and along the trails - some of which still exists even after FireSmart clearing activities from 2016 to 2019 - should be a priority and not removal of live vegetation close to our homes”</i>
Less FireSmart activities on public lands	<i>“My house backs onto one of the many storm ponds in town, which over the years has never been maintained by the city. The trees are mostly dead and the cattails are out of control. In my opinion this is a huge fire risk to all surrounding properties”.</i>  <i>“There are several green belts in the thick wood area that need cleaned up as per fire smart the municipality should address this”</i>
Concerns about limited FireSmart activities around newly constructed areas	<i>“We have long grass, dead fall and wood in the public field space behind our home. Part of the area in the field gets cleaned and mowed but the area along all the new constructions does not. I recognize the difficulty when building was still happening. But now that the construction is completed it would be more comforting if the municipality would ensure that this area was mowed when they did the areas farther from the homes”.</i>

	<i>"I'm concerned the RMWB is not being Fire Smart when they use wood chips as the ground cover at new and rebuilt playground sites in the city. Examples: Howard Pew Park, and Snye Point Park playgrounds"</i>
The need to maintain firebreaks around the city	<i>"It is important to have a fifty foot fire break around the city that in some areas should be better maintained 'cause we can't all live in Eagle Ridge or Wood buffalo Estates". "Build a fire break around the community that is useful to the people of the community in some way. How wide of a fire break would we need to be safe? Would it mediate risk? By how much? Is there a better plan? Household management is only useful when it comes to forest fires after the forest fire is a threat to a community and that is too late"</i>
Tree-cutting and vegetation removal	<i>"Some mitigation measures went totally overboard e.g. 100m clear cutting in Birchwood trails. Fire smart has to be in place from 2036 onwards when the trees are reaching maturity again"  "The municipality jumps on board too fast with some ideas, FireSmart is ruining our trails, I got pneumonia from all the burning last year and our trails in Eagle Ridge are so ugly now. They are destroying the forest in a knee jerk reaction. They should only be tidying up underbrush and dead trees not cutting down hundreds of pines and leaving ugly snags standing. It's infuriating".</i>

### 4.7. Social pressure

We asked participants about their neighbours’ actions on mitigation. We found that while 39% of the participants agreed most people in their neighborhood had taken mitigation measures (such as those listed in section 4.5), 24% disagree and the rest maintained a neutral view (Table 10).

**Table 10: Participants’ views towards their neighbors’ mitigation activities**

	Mean <sup>a</sup>	SD	Agree <sup>b</sup>	Disagree <sup>c</sup>
Most people in my neighborhood take measures such as those listed above in order to protect their homes from wildfires	3.2	0.8	39%	24%
Residents in my neighborhood work together to solve local problems	3.1	0.9	32%	25%
Those who own rental properties in my neighborhood are equally interested in mitigating wildfire risk as other residents	2.7	1.0	20%	11%
Seasonal residents in my neighborhood are equally interested in mitigating wildfire risk as other residents	2.7	0.9	15%	37%

<sup>a</sup>1= Rated on a scale from 1= strongly disagree, 5= strongly agree

<sup>b</sup>1&2 on 5-point scale.

<sup>c</sup>4&5 on 5-point scale.



While 32% of the participants agreed with the statement that “residents in my neighborhood work together to solve local problems”, 25% disagreed and the rest (43%) maintained a neutral view. Some participants expressed their views that their neighbours were not as proactive as themselves in completing FireSmart mitigation measures on their properties, which they found negatively influenced their motivation towards completing the same. In the words of two of the participants:

*“I live on a small property with only one tree on my property that has been trimmed to remove all dead branches. Neighbours have trees that are dead and/or have dead branches that require removal but that hasn't happened. We all have to work together to mitigate this ever happening again”*

*“I keep my yard clean. I also mow the utility lane behind our house & neighbours. This keeps down pests and reduces fuel (a lot of people walk back there & toss cigarettes into the grass). In dry periods I have put my sprinkler on back there to reduce the risk. Some neighbors toss their yard waste behind theirs adding potential fuel. (Bylaw should enforce this better). I grew up in southern AB and experienced grass fires fuelled by wind. Farms that kept grass cut and maintained were spared. My neighbors also have dying spruce trees which is scary when thinking of fire”*

Participants were asked if they thought those who owned rental properties and seasonal residents in their neighborhood were equally interested in mitigating wildfire risk as other residents. As shown in table 10, we found 20% agreed, 11% disagreed, and 69% were neutral. Two of the participants expressed their concerns about the limited FireSmart actions taken by their neighbors who own rental homes and absentee homeowners in the comments section:

*“I find efforts on my property is limited by the numerous rental homes in my area that are never maintained. For example, there are yards that have not been maintained since the homes were built ten or more years ago. The homes are built close together and I worry that during a wildfire there would not be adequate resources to prevent structure fires from spreading”.*

*“Very concerned about empty lots in our neighbourhood that are not maintained by their owners. Tall grass and junk that makes it more of a fire hazard”.*

## 4.8. Homeowners’ policy and fuel management preferences to promoting FireSmart properties

Participants were presented with a list of options that could potentially help motivate homeowners to reduce wildfire risk around property. These include educating homeowners, reducing insurance premiums, establishing community clean-up groups, providing free FireSmart assessments, and creating bylaws on (1) vegetation management, (2) fire-resistant building material on new homes, (3) retrofitting of homes that do not meet FireSmart standards, and (4) prohibiting residential development in high risk areas. Most of the measures received various levels of support. The measures that received the highest level of support were reducing insurance premiums for those who complete recommended mitigation activities (83%), educating homeowners about ways to reduce wildfire risk on their properties (79%), and providing free FireSmart home and property assessments to homeowners to identify potential wildfire hazards (77%) (Figure 11). About 2/3 of the participants supported establishing community clean-up groups to help people prepare their neighborhoods for wildfires, while 60% favoured the idea of creating bylaws requiring the use of fire-resistant building materials on new houses (Table 11). About half of the participants were in favour of prohibiting houses from being built in high-risk areas. There was less support for creating bylaws requiring homeowners to remove shrubs, trees, and dead branches close to homes. Creating bylaws requiring homeowners to retrofit parts of their home that did not meet FireSmart standards was the least favoured option with only 26% in support (Table 11).

**Table 11: Homeowners’ FireSmart policy and communication preferences** (*participants were able to select multiple responses*)

	Mean <sup>a</sup>	SD	Favour <sup>b</sup>	Oppose <sup>c</sup>
Educate homeowners about ways to reduce wildfire risk on their properties	4.1	0.7	79%	2.1%
Create bylaws requiring homeowners to remove shrubs, trees, and dead branches close to homes	3.2	1.3	48%	32%
Reduce insurance premiums for those who complete recommended mitigation activities	4.2	0.9	83%	7%
Establish community clean-up groups to help people prepare their neighborhoods for wildfires	3.8	0.8	66%	5%
Provide free FireSmart home and property assessments to homeowners to identify potential wildfire hazards	4.1	0.8	77%	4%
Create bylaws requiring the use of fire-resistant building materials on new houses	3.5	1.3	60%	23%
Create bylaws requiring homeowners to retrofit areas of their homes that do NOT meet FireSmart standards.	2.6	1.2	26%	49%
Prohibiting houses from being built in high-risk areas	3.4	1.2	50%	25%

<sup>a</sup>Rated on a scale from 1= strongly oppose, 5= strongly favour

<sup>b</sup>4&5 on 5-point scale.

<sup>c</sup>1&2 on 5-point scale.

The table below summarizes some of the opinions of the participants regarding the various policy and fuel management preferences to promote FireSmart properties.

**Table 12: Participants’ opinions on ways to promote FireSmart**

<b>Main Themes</b>	
Provide financial incentives (e.g. reduced insurance)	<p><i>“People should get a tax break on things that fire smart like roofing and vinyl fencing. The cost is just too high for most people to afford”</i></p> <p><i>“The wildfire wasn't fun, but the insurance racket has been far worse than anything I could have imagined”</i></p> <p><i>“I'm all for changing building materials. Subsidies must be provided by different level of government”</i></p> <p><i>“Tax breaks if FireSmart activities are conducted i.e. replacing siding”</i></p>
Education	<p><i>“Teach wildfire safety in schools. Don't ban off highway vehicles unless conditions are extremely dry. Educating the public is more important than bans and laws. Common sense goes a long ways”</i></p> <p><i>“Education is always good, and should be provided to each home. We must be very careful of enforcing bylaws that can be abused by builders and fly by light contactors. Here has been enough of that already since the fires”</i></p> <p><i>“Would like to see education efforts so that people can review information to see how they can protect their own properties. With the education information, would benefit readers to have contact information should they have questions or need clarification regarding what they have read or seen”</i></p>
By laws and regulations	<p><i>“I truly believe the municipality should offer compost removal cans for garbage and force bylaws in Fort McMurray example lawns mowing leaf raking etc.”</i></p> <p><i>“City should consider a bylaw to control the backyard campfire in any neighbourhood”</i></p> <p><i>“Be pro active and have maintained firebreaks in place. Stricter regulations about OVH use”</i></p>
Support on FireSmart home and property assessment	<p><i>“Would be interested in a reasonable assessment of wildfire risk of our property that is non-judgmental, i.e., that would provide information/walk-through of property without potential penalty assessments”</i></p> <p><i>“I did have a fellow come and do the fire smart assessment of our property, but I never received the report of it”</i></p> <p><i>“There is no report after FireSmart assessment to my property”</i></p> <p><i>“I had a fire smart assessment done, they came and left a bag on my door, but I was never emailed the recommendations.”</i></p>

## 5. Discussion and recommendations

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The majority of the participants (89%) had a direct experience with evacuation during the Horse River wildfire, when more than 88,000 residents of Fort McMurray (almost the entire city's population) were evacuated. However, relatively few of the participants experienced home loss or property damage. We found although many of the participants had gone through a direct experience, most of the participants generally perceived a low to moderate wildfire risk to their properties. Some even held the view that there was a low chance of a catastrophic fire happening soon. Due to large-scale tree cutting around the city, as part of the on-going municipal level FireSmart activities following the Horse River wildfire, some participants expressed their optimism that 'enough' had already been done to reduce an immediate risk.

Experience with hazard has long been identified by researchers as one of the many factors influencing residents' risk perception and the adoption of mitigation measures (Faulkner et al. 2009; McFarlane et al. 2011; Nox and Miles 2017; McCaffrey et al. 2020). However, the relationship is complicated. In some cases, experience can increase risk perception and help stimulate mitigation behaviour; in other cases, it can decrease risk perception by creating a feeling that "lightning does not strike twice" (McCaffrey et al. 2020, p.165). Research completed in communities in southern Alberta found that residents' lower risk perception could be attributed to the extent of the large area burnt; the infrequency of large fires; the infrequency of hot, dry summers; or a combination of these factors (McGee et al. 2009). It is also possible that residents could perceive a higher risk in their area or region but could down play the risk to their particular homes (Nelson et al. 2004), which was also found in this study.

Hazard experience can also increase risk perception so much that residents develop a feeling of fatalism, where they believe no steps can be taken to effectively reduce risk and that we are at the mercy of nature. Our results support these previous findings as a few participants felt they lived in an area at extremely high risk to wildfires and felt risk reduction efforts were futile – it is important to note that this was a minority viewpoint. Such conflicting views held by the residents regarding the likelihood of wildfire risk and its potential impacts could have a negative implication on homeowners' FireSmart mitigation behavior. Informing the residents of the potential risk and the likely response action they could do at their disposal is a necessary first step in mitigation (McGee et al. 2009). One idea would be to make fire history maps of the region available to residents on the RMWB website, to show residents they live in an area frequently impacted by wildfire. Another idea is to showcase other communities that had been threatened by large wildfires but where community and homeowner mitigation activities reduced the effects. Documented American examples include Circle Oaks, Napa, California; Thomas Fire, Montecito, California; and High Park Fire, Redstone Canyon, Colorado. Hessel

and Ergibi (2017) found in the National FireSmart Survey that respondents who perceived a fire risk to their homes were 5 times more likely to undertake mitigation activity.

We also examined if risk perception was influenced by other factors such as gender, income and length of residency in the city. Concerns about wildfires remained the same for long-term residents and newcomers alike; we found female participants tend to have slightly higher risk perceptions compared to their male counterparts. The latter is consistent with research conducted elsewhere (e.g. in Australia), which found that women tend to have a higher risk perception and thus likely to want to evacuate when confronted by wildfires (see Eriksen et al. 2010; Whittaker et al. 2013). Women are often ignored or missed when communicating about wildfire. Some communication efforts could therefore be targeted at women or targeted to events where a high proportion of women attend (craft sales, farmers markets, school activities, women-only gyms, etc.) instead of generic 'head of household', which often means men. Past studies have shown a relation between income level and wildfire mitigation activity, which we did not. The likely reason is the very high level of income of the majority of residents of Fort McMurray, and our sample. We simply did not have enough stratification of income levels to determine any correlation. Another study on uptake of FireWise actions in the USA found that income becomes important around incomes of \$80k and upwards, but with low significance (Absher et al. 2013).

Our findings suggest homeowners had a moderate level of knowledge regarding FireSmart mitigation, with just under half of the participants having searched for information about FireSmart. Of those that did, the top three information sources were the internet in general: the RMWB website and social media more specifically. Only 1/3 of the participants stated they have looked at or read any one of the FireSmart manuals available online on the RMWB website, the Government of Alberta website, or the FireSmart Canada website. In the National FireSmart survey, only 26% said they had ever heard of FS (Hesseln and Ergibi 2017), so the level of awareness of FireSmart in the RMWB is much higher. However, having information or knowledge of FireSmart did not translate into substantial adoption of recommended mitigation actions. Other studies have found the reliance on increasing name recognition of a program does not translate well for programs that require behavioural change (Christianson et al. 2011). In the National FireSmart survey, 42% cited a lack of knowledge for why they have not implemented FireSmart recommendations. The next highest was lack of money at about 25% (Hesseln and Ergibi 2017). Interestingly, while half of the participants believe their house is FireSmart, most of the other participants were unsure. More or less consistent with our findings, a recent municipal-wide survey study completed by the RMWB FireSmart engagement team found that out of the 341 residents, only 41% had actually made FireSmart changes to their homes since the May 2016 wildfires (Quinn 2018).

The majority of participating homeowners were not interested in completing a FireSmart assessment of their home and property. As discussed below, when asked what policies would help mitigation in their community, 77% were favourable to the provision of free FireSmart assessment, and 79% favoured better public education. Our questions do not permit analysis of these conflicting views between desire for their property, and desire for the community as a whole. The dissonance in these findings could suggest that participants do not see themselves at risk, and only see others as needing help. The most frequently cited reason for not wanting a personal assessment was that they did not consider the threat of wildfire significant enough. Other cited reasons included financial and time constraint, not being a priority and a lack of knowledge on how to conduct the assessment by themselves. Four of the participants mentioned they had a FireSmart assessment done on their property, but they did not receive the report of the recommended measures.

These findings have important implications on the need to do more education, support and follow up on FireSmart to ensure homeowners understand, are motivated and encouraged to implement the recommended mitigations actions. Although a number of factors determines the success of public education, the method of communication is a vital component in successful risk reduction initiatives (McGee et al. 2003). Christianson et al. (2011) examined 13 case studies of wildfire mitigation in Alberta, and found the most successful programs with the highest rates of adoption and community support relied on a risk communication approach; this is when focus was put on two-way communication between residents and a trusted risk manager. There were similar findings in the USA, where Shindler (2007) found that successful programs could be traced to one individual with strong communication skills who was respected in the community.

For vegetation management and fuel reduction measures, the two most widely implemented activities were cleaning up of fallen branches, dry grass and needles from within 10 metres of home and keeping rain gutters and roof free of leaves, needles, and branches. It appears that of the suite of possible recommended vegetation management activities, the least popular were those that involved the cutting of trees although the majority of participants were still doing it. The National FireSmart survey had very similar results (Hesseln and Ergibi 2017). Providing expert advice on the type of trees and vegetation that could be planted as a more FireSmart alternative during in-person FireSmart home assessments may encourage homeowners who are reluctant to replace higher risk trees on their properties. Municipal FireSmart engagement plans need to incorporate local expertise from a range of professionals, such as landscape architects, who would be able to provide local expert advice on residential landscaping for promoting FireSmart properties without compromising homeowner values.

As was found in other WUI communities in Alberta (e.g. Edson, Grande Cache, High Level, Hinton, Peace River and Whitecourt), homeowners tend to focus more on low-cost, low effort

mitigation measures (McGee et al. 2009). As noted in the result section, participants gave multiple reasons for not undertaking risk reduction activities: (1) it was a low priority, (2) they needed for more information, (3) low fire risk perception, (4) a lack of skills, (5) a lack of money, (6) physical inability and (7) a preference to natural connectedness over tree cutting/vegetation removal. Other factors that appeared to influence homeowners' implementation of vegetation measures included having too small of lots to adopt some of the recommended measures (e.g. moving wood piles 10 metres from a house), social pressure, and shifting responsibility away to firefighters, the city, or the municipal government. Some participants were willing to accept potential wildfire risk due to lifestyle choices. Research completed mainly in the USA has had similar findings. Despite higher risk perceptions associated with dense vegetation, residents were not willing to engage in vegetation management to minimize their hazard exposure because of environmental preferences or preferences for the 'natural' aesthetics offered by dense forest environments (Winter and Fried 2000; Nelson 2005; Brenkert-Smith et al. 2006; Collins 2009).

On a positive note, participants did indicate that conducting mitigation activities would make firefighters' job easier. The continued involvement of the local fire department in FireSmart activities, promotional materials, and home assessments could further entrench the fact that conducting these activities is helpful for fire crews, perhaps making it more likely for homeowners to be willing to undertake such measures. Some participants felt on-going municipal level FireSmart activities (e.g. maintenance of city firebreak) would be enough to protect them from future risk.

We also examined homeowners' acceptance and implementation of structural mitigation measures focusing on roofing and siding. With regard to roofing, we found an overwhelming majority of the participants had asphalt shingles, mostly because it was on their roof when they bought their house. The use of asphalt roofing is common in new house constructions in Alberta since 2000 (Faulkner et al. 2009). Vinyl was the most common siding material on participants' homes. It is known the use of vinyl for siding can decrease the likelihood of a house surviving a wildfire as this material can melt when exposed to high temperatures, allowing the fire to reach the underlying wall components and penetrate the interior of the building (FireSmart Canada 2019). The majority of the respondents said the siding material was already in place when they bought the house. Similar to asphalt shingles, vinyl is the commonly used siding material for house construction because of its low cost. As most housing constructions in the Fort McMurray area is done by developers, it appears homeowners stuck with what builders provided.

Of the participants who had vinyl as a siding material, very few said they were willing to replace their sidings, and out of those, only a third of the respondents stated they expected to make this change within the next five years. Cost was the single biggest factor for why participants



were unwilling to change from vinyl siding. Most residents viewed recommended structural risk reduction measures such as changing roofing and siding as expensive. This finding is consistent with the literature, which indicates that costly home construction measures such as roof and siding replacement are least likely to be undertaken by homeowners (Brenkert-Smith et al. 2006; McFarlane et al. 2011). Part of it has to do with how much uncertainty is involved in homeowners' cost-benefit calculation surrounding its adoption. In discussing factors that play role in the adoption of a new practice, Rogers (1995) noted that perceived relative advantage is a key predictor to adoption rates. So, if homeowners perceive a relative advantage of using FireSmart home construction (in terms of economic, social and risk reduction perspective), they are more likely to make the change. There are no recommended methods to convince folks that a new roof "just in case" a fire occurs is worth it. The potential for financial loss is just too nebulous. We argue for the importance of financial incentives further in the discussion.

Some participants felt the municipality should focus on city level mitigation activities such as the creation of firebreak and defensible space around the perimeter of the city. This is consistent with other research findings which suggested municipal level risk reduction activities (e.g. fuel management, fireguard) and firefighting resources can provide a false sense of security among homeowners, making them believe those actions and resources would be enough (McCaffrey et al. 2013). Several participants felt their neighbours were not as proactive as they were in completing FireSmart mitigation measures on their properties and expressed their concerns about the limited FireSmart actions taken by their neighbors who own rental homes and absentee homeowners, which influenced their willingness to undertake mitigation. Past research has suggested that conditions on adjacent lands could be a consideration for homeowners' mitigation decision. Studies relate this factor to subjective norms (also known as social pressure) to denote the influence of neighbours on residents' mitigation behaviour (McCaffrey et al. 2013; Nox and Miles 2017). For example, homeowners' may feel discouraged to perform mitigation works around their property if they think their neighbourhoods are doing nothing to reduce risk (Weisshaup et al. 2007). It is therefore important to understand that there may not be a simple pattern in the implementation of FireSmart recommended mitigation measures among homeowners; and such differences are driven by psychological, socioeconomic, and situational influences. The task of FireSmart engagement officials is to consider the diversity of views and tailor messages to specific groups of homeowners/neighborhoods.

As discussed above, studies of successful programs have shown the importance of personal (one on one) communication, preferably by a 'champion' such as fire department staff. Our results show there are very diverse reasons for no-implementation, driven by reasons such as psychological, social, and situational influences. It would be necessary that the contact sessions include a discussion of why they are hesitant, with pre-prepared counter arguments for any



such influences. Research findings in British Columbia also suggest the role of change agent or “champions” (can be fire chiefs, political leaders, forestry workers or community members) in providing information, create interest in, and support homeowners in their effort to adopt recommended mitigation measures (Labossiere and McGee 2017), similar to findings from Shindler (2007) in the USA that successful wildfire mitigation programs can often be traced to one person. Providing free FireSmart home and property assessment might also serve as an incentive as this is supported by 77% of the participants. Hesseln and Ergibi (2017) also found in the National FireSmart Survey found that respondents considered providing “technical assistance” to be a strong incentive, though they did not specifically mention FireSmart home and property assessments.

Although the above factors appeared to influence homeowners’ implementation of residential mitigation measures in varying degrees, most survey respondents viewed mitigation as a shared responsibility. Many of the respondents attributed the responsibility of mitigating wildfire risk on their property to themselves as well as to the municipal and the provincial government. Some residents shifted responsibility to the fire management agencies, placing less responsibility on themselves to reduce wildfire risk. These findings of homeowners’ attribution of wildfire mitigation responsibilities is consistent with the finding of other similar studies completed with five WUI communities in Alberta (McGee et al. 2009). Such perception of who is responsible for wildfire mitigation might influence the implementation of homeowners FireSmart (McGee et al. 2009). It is therefore crucial residents should be made aware that mitigation is a shared responsibility. Thus, in addition to personal contact, there should be regular neighbourhood meetings, where the importance of participation by all is highlighted. Showing the usefulness of mitigation could be highlighted by showing the results of Westheaver (2017) who noted that among the homes which survived the Horse River wildfires, most had completed recommended FireSmart guidelines.

As our findings suggest, providing financial incentives may encourage homeowners to undertake risk reduction activities including those requiring changes to roofing and siding. In fact, of all the measures presented to the participants, the measure that received the highest level of support was reducing insurance premiums for those who complete recommended mitigation activities. This was also found in the National FireSmart survey conducted by Hesseln and Ergibi (2017). Another supported financial incentive was providing subsidies such as tax-breaks for those who are willing to change to fire-rated building construction materials. It is worth pondering whether recommendations should be made to homeowners that they are completely unlikely to adopt – often the high cost recommendations like siding replacement - unless some financial incentive can be given.

Educating homeowners about ways to reduce wildfire risk on their properties should be a key consideration. Hesseln and Ergibi (2017) in the National FireSmart Survey found that more

education and communication were the top rated incentives listed by respondents. However, focusing on simple recognition of the name 'FireSmart' through social marketing (i.e. billboards, 'swag') is often expensive but does not increase actual adoption of FireSmart activities (Christianson et al. 2011). Studies have shown that communication using interactive processes (e.g. one-on-one interactions with agency personnel, experts, peers, neighborhood) are key for success as this allow residents ask questions, clarify misperceptions and identify potential barriers that might need to be addressed (McCaffrey and Olsen 2012). Agency outreach efforts (e.g. municipal FireSmart engagement program) resting on such interactive information sources can be seen as more useful and trustworthy and can positively influence assessment of agency activities and whether individuals adopt mitigation measure (Steelman et al. 2014).

Our findings suggest there was less support for creating bylaws requiring homeowners to remove shrubs, trees, and dead branches close to homes. Creating bylaws requiring homeowners to retrofit their homes to meet FireSmart standards was the least favoured option. Those participants expressed concerns that such coercive measures infringe on people's choice in managing their properties as per their own preferences. However, introducing requirements for developers to use a fire-rated construction material on new house constructions was more popular. Hesseln and Ergibi (2017) recommended that any attempt at increasing participation should rely on methods that are positive, not punitive.

About 2/3 of the participants supported establishing community clean-up groups to help people prepare their neighborhoods for wildfires. Although this study is limited to homeowners' mitigation actions on private property and did not conduct a thorough examination of community level mitigation activities, it does, however, provided some insight into the need for mobilizing neighborhood or community level mitigation activities. Neighborhood actions not only help encourage residents to complete mitigation activities on their properties but also serve as an opportunity for sharing experiences; for example, how homeowners are implementing recommended mitigation measures to reduce wildfire impacts on their house. This will help municipal and provincial government's efforts to establish wildfire mitigation as a social norm (Faulkner et al. 2009). Staff of the RMWB should be encouraged to spend time and funds to organize and support community FireSmart groups.

## Summary of Recommendations

- Make fire history maps of the region available to residents on the RMWB website, to show residents they live in an area frequently impacted by wildfire.
- Showcase other communities that have been threatened by large wildfires but where community and homeowner mitigation activities reduced the impact. Documented American examples include Circle Oaks, Napa, California; Thomas Fire, Montecito, California; and High Park Fire, Redstone Canyon, Colorado.

- Consider conducting targeted communication at women or targeted to events where a high proportion of women attend (craft sales, farmers markets, school activities, women-only gyms, etc.) instead of generic ‘head of household’ campaigns.
- Provide alternatives for homeowners instead of vegetation removal. FireSmart does not mean vegetation-less. Providing expert advice on the type of trees and vegetation that are FireSmart alternatives during in-person FireSmart home assessments may encourage homeowners who are reluctant to replace higher risk trees on their properties.
- The continued involvement of the local fire department in FireSmart activities, promotional materials, and home assessments could further entrench the fact that conducting these activities is helpful for fire crews, perhaps making it more likely for homeowners to be willing to undertake such measures.
- Homeowners need to perceive that it is worth investing in mitigation actions. This may mean investing resources in communicating about the measure that are most likely to be adopted that will have the largest impact on fire risk reduction.
- It is worth considering whether time or resources should be spent on encouraging or promoting activities that homeowners are unlikely to adopt – often the high cost recommendations like siding replacement - unless some financial incentive can be given.
- All residents who make the effort to participate in a FireSmart home and property assessment should be personally followed up with.
- Staff of the RMWB should be encouraged to spend time and funds to organize and support community FireSmart groups.
- Municipal FireSmart engagement plans should incorporate local expertise.
- Successful wildfire mitigation programs can often be traced to one person - a change agent or “champion” (can be fire chiefs, political leaders, forestry workers or community members). These people should be supported.

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