

How historic and current wildfire experiences in an Aboriginal community influence mitigation preferences

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Abstract. Peavine Métis Settlement is located in the boreal forest in Northern Alberta, Canada. The objective of this paper was to explore how different wildfire experiences in an Aboriginal community influence wildfire mitigation preferences at the residential and community levels. Residents of Peavine had varying experiences with wildfire over an extended period of time including traditional burning, firefighting employment and bystanders. Despite these different experiences, participants still implemented or supported wildfire mitigation activities, although for differing reasons depending on experience type. Participants were found to have implemented or supported wildfire mitigation activities on the settlement, including their own properties and public land. Experience type influenced why wildfire mitigation had been implemented or supported: primarily wildfire risk reduction (firefighters), primarily aesthetic benefits (bystanders) and for both aesthetic benefits and wildfire risk reduction (historic traditional burners). The extensive fire experiences of residents at Peavine Métis Settlement have provided insights into how experience influences mitigation preferences. The results show it is important to consider predominant wildfire experience types in a community before developing a wildfire mitigation program. The findings of this study may have relevance for other Aboriginal communities that have experience with wildfires.

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Introduction

Aboriginal people^A in Canada have an extensive history with wildfire^B. An indication of the pervasiveness of fire in Aboriginal life is the fact that there are 275 Cree words whose definitions include the English word fire (see <http://www.creedictionary.com/search/?q=fire&scope=0>, accessed 12 March 2012). However, it is not clear how wildfire is currently perceived and mitigated by Aboriginal or other Indigenous^C communities (Spillman and Cottrell 2004; Raish *et al.* 2007). This type of research is important today, as factors such as climate change (Flannigan *et al.* 2006; Tymstra *et al.* 2007), mountain pine beetle (*Dendroctonus ponderosae*) (Canadian Forest Service 2005), and the build up of fuel from a history of fire suppression and cessation of Aboriginal burning practices have increased the wildfire risk to many communities, particularly remote, isolated Aboriginal communities. Most Aboriginal peoples have experienced wildfire as bystanders, where they have witnessed a wildfire in or near their community. Multiple

Aboriginal communities at high risk from wildfire are located in the boreal forest, and are regularly evacuated due to wildfires (Fig. 1). There is a need for Aboriginal community-based wildfire mitigation strategies that address local values and needs, and are supported by local residents. This paper presents results from a study conducted with Peavine Métis Settlement in Northern Alberta and focuses on how wildfire experiences influenced residents' mitigation preferences.

In Canada, Aboriginal groups have a history of using traditional burning practices to manage the environment (for examples, see: Lewis 1982; Lewis 1988; Stewart 2002; Miller and Davidson–Hunt 2010). There are distinct differences regarding wildfire and traditional burning practices. Wildfires generally occur in high-hazard months due to a variety of natural and human causes, and result in high-intensity, dangerous fires. Traditional burning practices consist of starting low-intensity fires during periods of reduced fire risk, such as the spring month or late fall, with some sort of purpose in mind (i.e. improving

^AAboriginal people in Canada are comprised of First Nations, Inuit and Métis, as defined in the Constitution of Canada (Department of Justice Canada 1982)

^BThe term 'wildfire' refers to a fire in which 'wild' vegetation was burned. This can include forest fires, grass fires and brush fires. The use of the term 'wild' does not imply that the fire was or is out-of-control. The term wildfire also does not imply causality. Wildfires can be started by natural or human sources.

^CIndigenous peoples refer to the original peoples internationally who have experienced colonisation. It is a term that emerged in the 1970s from the American Indian Movement and the Canadian Indian Brotherhood (Smith 1999).

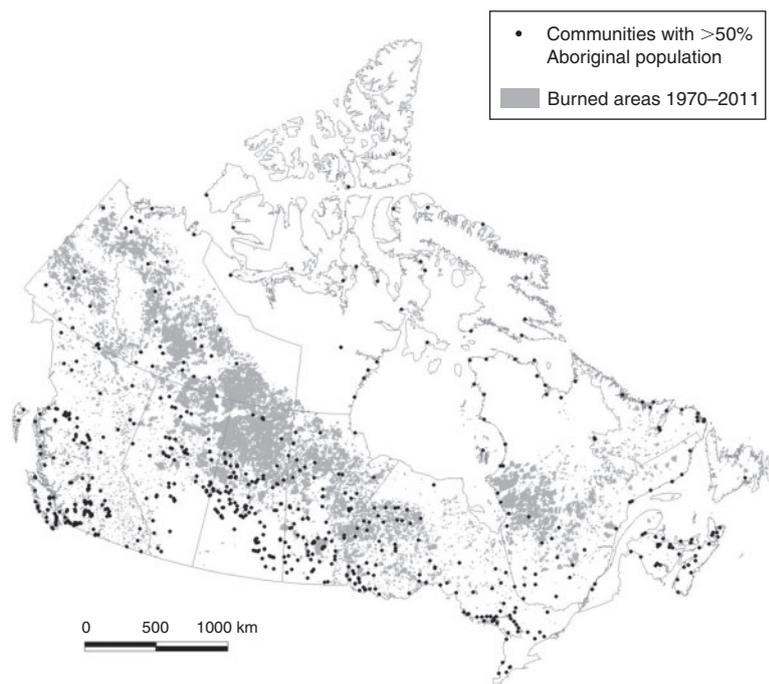


Fig. 1. Locations of communities in Canada with Aboriginal populations greater than 50%, as well as wildfires between 1970 and 2011.

habitats to draw animals to the area or improving conditions for plant growth). In Alberta, traditional burning was officially banned in 1910 by the government in order to protect timber, watersheds and communities (Murphy 1985; Pyne 2007). By the end of World War I, burning was restricted to the most remote and isolated areas of the province where it was easiest to avoid prosecution (Lewis 1977). Despite fines (C\$25) and jail sentences (40 days) for burning without a permit (Ferguson 1979) some burning continued, but much of the knowledge regarding traditional burning practices was lost in Alberta by the 1970s (Lewis 1982).

Aboriginal people also have a history of firefighting employment in Alberta. Historically, Fire Rangers in the province had the authority to force men to fight fires. Anyone unwilling was fined or sent to jail (Murphy 1985). Aboriginal peoples fought wildfires for a very low wage (Holt 1998). Eventually, pay was increased and Aboriginal people began to consider firefighting as acceptable employment (Ferguson 1979; Driben 1985). Fire suppression was thoroughly conducted in Alberta by 1960, and 'job fires' were occasionally set to create employment opportunities (Ferguson 1979). However, a change to firefighting practices in the mid 1990s in Alberta, including an increase in wages and fitness requirements, caused firefighting to become a sought-after job opportunity for non-Aboriginal people. Some Aboriginal people were unable to continue firefighting because of fitness and training requirements. Most Aboriginal firefighting crews in Canada are now contract crews, which are on call and paid only when they are fighting a fire or on standby (Moseley 2007).

Background

It is uncertain how experience with a hazard affects whether or not someone will implement hazard-mitigation activities, as

studies have identified hazard experience as encouraging (Lindell and Prater 2000; Grothmann and Reusswig 2006), discouraging (Johnston *et al.* 1999; Paton *et al.* 2001) or having no influence (Russell *et al.* 1995; Tekeli-Yeşil *et al.* 2010) on the implementation of mitigation measures. Researchers have examined the influence of wildfire experience on wildfire mitigation preferences in non-Aboriginal communities (Weinstein 1989; Nelson *et al.* 2004; Vogt *et al.* 2005; Martin *et al.* 2007; Martin *et al.* 2009; McGee *et al.* 2009). Fire experience did not influence residents' acceptance of prescribed burning, mechanical fuel reduction and defensive space ordinances in communities in California, Florida or Michigan (Vogt *et al.* 2005), and in Minnesota and Florida, participants who had experienced wildfire were no more willing to implement residential mitigation activities (Nelson *et al.* 2004). In communities in Oregon and Colorado, experience with wildfire did not directly affect residents' implementation of mitigation measures (Martin *et al.* 2009). Residents in Michigan who experienced a wildfire were left feeling future mitigation efforts would be futile (Winter and Fried 2000). However, a different study in California, Florida and Michigan found participants had numerous and diverse wildfire experiences that influenced their support for wildfire mitigation activities involving defensible space (Vogt 2003). In Canada, McGee *et al.* (2009) found differences in residents' fire experiences resulted in varying acceptance and adoption of mitigation activities. For example, participants not evacuated during the wildfire had implemented two additional mitigation measures in the year following the fire, participants who evacuated had completed an average of one new mitigation measure on their property, and participants who had lost their homes had not completed any new mitigation measures post-fire (McGee *et al.* 2009). These varying results show the influence of fire experience on mitigation preferences is complex and requires further study.

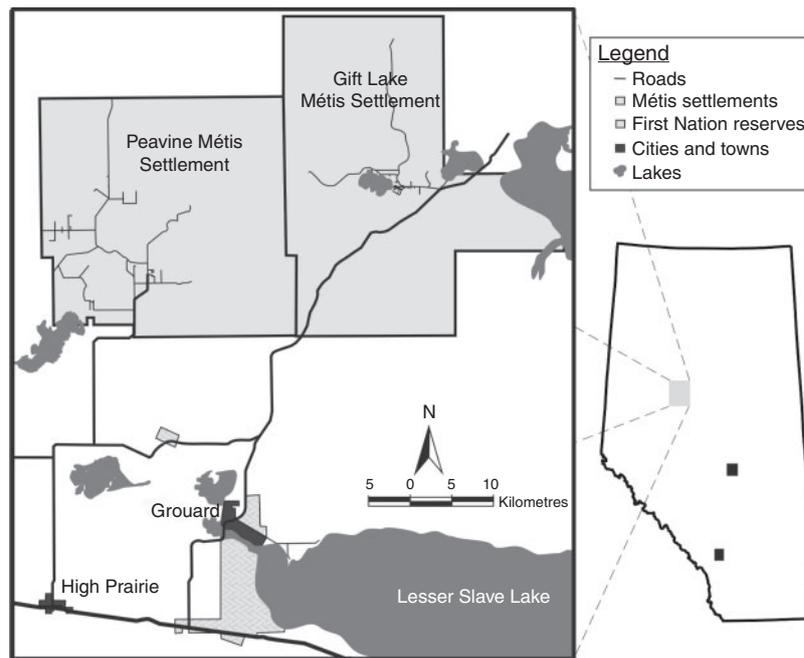


Fig. 2. Location of Peavine Métis Settlement.

Even less is known about how the fire experiences of Indigenous peoples influence mitigation preferences. Carroll *et al.* (2010) examined how Indigenous peoples' burning practices and firefighting experience affected wildfire risk perception and community-level mitigation amongst the Nez Perce tribe of the Pacific Northwest (US). They found knowledge from both traditional burning and firefighting resulted in a hybridisation of knowledge which increased support for prescribed burning. Monaghan (2004) studied contemporary wildfire mitigation in two Aboriginal communities in Northern Australia and found Aboriginal residents were experienced with fire, through both traditional burning practices and experiencing wildfires. Aboriginal residents of these communities were knowledgeable about wildfire mitigation, and were conducting mitigation activities such as prescribed burning, and removing high risk vegetation as a normal part of life. These mitigation efforts were informed, in part, by an adaptive application of Indigenous knowledge about fire ecology, effects and strategies to address contemporary fire risk and community needs. In this paper we build on these existing studies by examining how varying fire experiences influenced wildfire mitigation preferences in an Aboriginal community in Canada.

Methods

A qualitative community-based research project was developed with Peavine Métis Settlement located in Northern Alberta in the boreal forest (Fig. 2). The settlement covers 86 245 ha

(~213 117 acres) and is home to ~1000 residents who live in 249 private dwellings. Approximately 50% of the settlement is covered by early succession deciduous forests, the result of an extensive history with wildfire (see Fig. 3). The rest of the settlement is either mixed wood boreal forest or prairie. Settlement members can hold title to property (including homes)^D, but the settlement owns all property and structures. There are two hamlet areas consisting of homes located close together, but the majority of homes are located on large areas separated from their neighbours by forest. Homes are generally modest-sized bungalows, bi-levels or two stories with vinyl siding and asphalt shingles and generally have a lawn extending ~30 m around their home. Most properties are well kept. Infrastructure on the settlement includes 70 km of gravel roads, a paved road, three office buildings, a recreation centre, arena, school, water treatment plant, public works building, fire hall and a small building for Northern Lakes College. The closest town is High Prairie, located 56 km to the south. Approximately 60% of the population is under the age of 19, a percentage much higher than the broader province of Alberta where 26% of the population is under 18 (Statistics Canada 2008). Unemployment in the region was 10.6% in 2006, compared with an unemployment rate of 4.3% in the broader province at the same time (Statistics Canada 2007). Members are employed by the settlement (either in general operations or for one of the corporations owned by the settlement, which include a lumber mill, gravel company, oil field company and hotel) or in the neighbouring community of High Prairie in logging and other industries.

^DLand is communally owned on all the Métis settlements and distributed to members in three ways: Métis Title, Provisional Title and Allotments. The holder of Métis title has exclusive rights to use and occupy the land, make improvements and transfer the title. The maximum amount of land that a member can have Métis Title on is one hamlet lot and 175 acres (approximately one quarter-section) (Bell 1994). Provisional Métis Title can be granted by the Council (who holds Métis Title) to a settlement member so the member can use and make improvements to the land and eventually be able to apply for Métis Title (Bell 1994). This provisional title can be held for a fixed term of 5 years, and can be renewed for another 5. Allotments occur when a member already has Métis Title on the maximum amount of land (Bell 1994). The settlement can grant the member additional land for a fixed period of time for reasons such as farming, ranching and operating a business (Bell 1994).

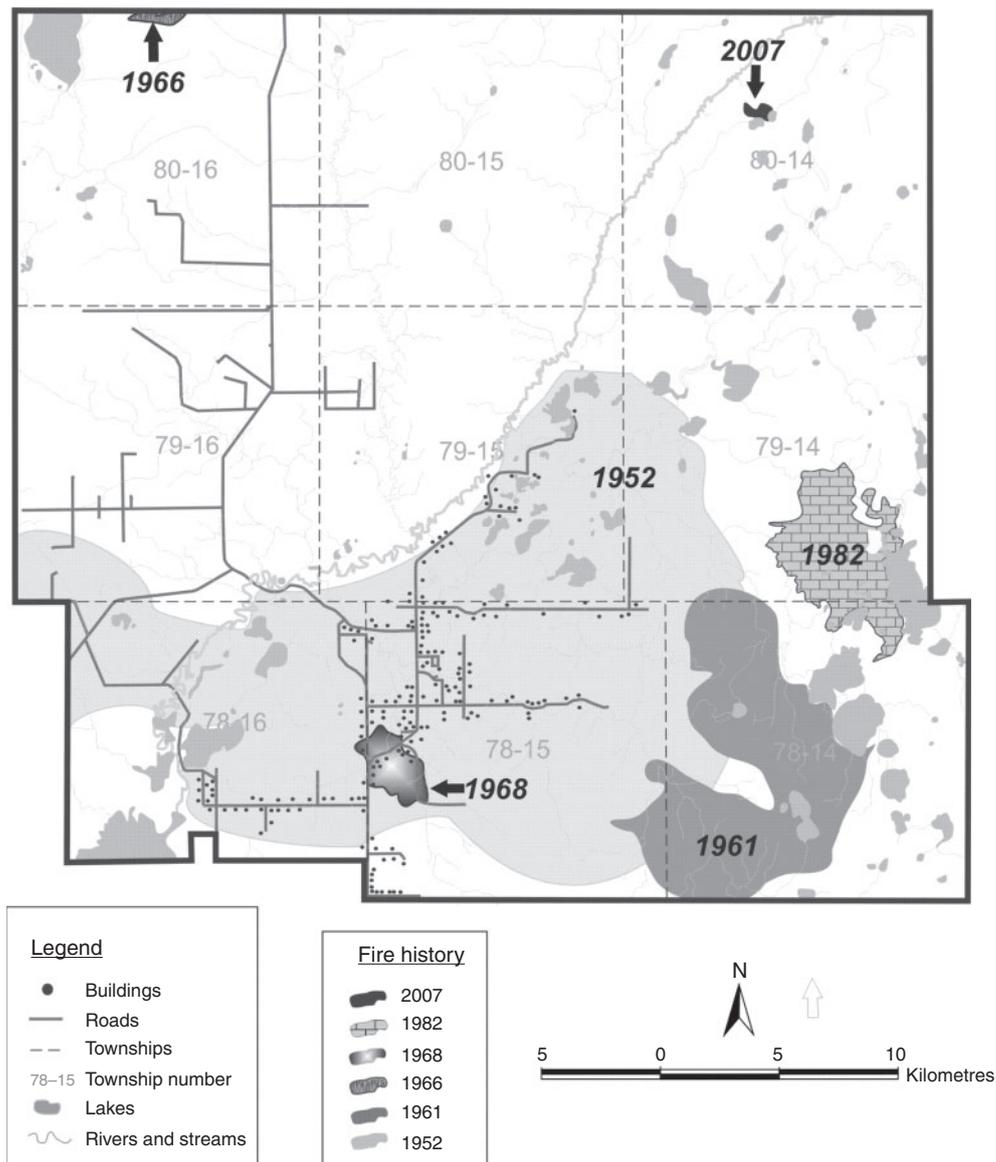


Fig. 3. Fire history at Peavine Métis Settlement as recorded by the Government of Alberta from 1950 to 2010 (Christianson *et al.* 2012; adapted from Government of Alberta 2010).

Peavine has a comprehensive wildfire mitigation program involving both residential and community activities, which was designed by the forestry coordinator (Christianson *et al.* 2012). The forestry coordinator at Peavine was approached by the first author to participate in developing a study regarding social issues associated with wildfire mitigation on the settlement. The council at Peavine approved the research proposal. A community advisory group was established by the first author to help guide the research and provide background on the community. This study used qualitative methods including semi-structured interviews with settlement members ($n=38$) and focus groups with settlement members who had been or were firefighters at

the time of the study ($n=2$ with 16 participants^E). Participants were selected using snowball sampling (Miles and Huberman 1994). All 48 study participants had some experience with wildfire, including traditional burning, firefighting and experiencing a wildfire as a bystander. Participants in both the interviews and focus groups were asked about their history and memories of the settlement, pros and cons of living at Peavine, their involvement in their community, past wildfires and firefighting on the settlement, wildfire risk perceptions and wildfire experiences. Participant observation was also conducted in the community during field visits to help verify results from the interviews and focus groups, and also to collect new data.

^ESix of the interview participants also attended a focus group, at their request.

When data collection was occurring in the community, the interviews and focus groups were transcribed and then coded for main themes. The majority of codes were developed from the data, with a few being informed by existing literature. The coding framework was revised to explore more specific themes and relationships once data collection was completed. Relationships between factors such as age, sex, time lived on the settlement, involvement in the community, reliance on the settlement and experience in wildfires were explored. Matrices were developed to help think through the relationships in the data. Check-coding by three researchers was used to ensure reliability of codes to ensure the reliability of codes. Each researcher coded a transcript separately, then came back to discuss the codes. On this first round, intercoder reliability^F was 75%. We then adjusted the coding framework and coded two more transcripts. When these transcripts were reviewed, intercoder reliability had improved to 95%. Snowball sampling, prolonged community involvement and participant observation, the involvement of a community research advisory group, triangulation and peer debriefing (all participants will be given back their transcripts including a brief summary by the research team to verify, as well as shown how their quotes would be used in this article to verify context) were used to ensure the rigour in data collection and analysis (Baxter and Eyles 1997).

Results

The Peavine fire experience

Peavine has a long history with fire. The first fire remembered by settlement members was a large wildfire in the early 1930s, before the opening of the settlement. Participants commented that when they moved to the settlement they settled in the burned area because there were fewer trees and bush to clear:

When we were kids ... it was almost clear here [from previous wildfires]. You could see everybody's house. You could yell. You [didn't] need a phone. [Participant 001, Elder]

A second large fire burnt through the southern section of Peavine in 1952. Participants indicated that no homes were burnt during this fire, although it did pass near structures. In 1982, the Pelican Lake fire occurred in the north-east area of the settlement. Some participants were involved in fighting this fire. Participants recalled they could see the flames at night, the air was full of smoke and ash fell on homes. Benefits associated with these fires identified by participants included the cleaning of deadfall and rebirth of young healthy forests which increased subsistence activities such as berry picking and hunting. Other fires on the settlement recorded by the Government of Alberta occurred in 1961, 1966, 1968, 1982 and 2007 (Fig. 2). None of the fires resulted in resident evacuation, however these experiences influenced the worldviews of settlement members regarding wildfire.

Fires are now relatively rare on the settlement, due to strict fire control and a reduction in hazardous fuels due to past fires. However, small wildfires still occur. There were 27 minor wildfires between 1990 and 2000 with 53% human caused and

47% lightning caused (Walkinshaw 2001). The majority of the fires were less than two hectares in size. From 2005 to 2010, there have been approximately six fires per year on the settlement. Many of these were small and extinguished by settlement members. At the time of this study, trees killed by the mountain pine beetle had increased the fuel load on part of the settlement, increasing wildfire risk. The Peavine forestry coordinator estimated 40% of the settlement is at low risk, 30% at medium risk and 30% at high risk from wildfire. The settlement currently has a wildfire mitigation program, which includes year round programs (such as financial assistance to purchase lawn tractors) and seasonal activities (such as vegetation management) on both residential properties and public lands (Christianson *et al.* 2012).

Settlement members have also experienced wildfires outside the settlement. Many participants recalled the 'Jackpine' wildfire north of High Prairie in the 1990s, which closed the highway to Peavine. Participants also witnessed the 2001 Chisholm Lake fire and smaller fires near the community of Slave Lake. The devastating Flat Top Complex fire of 2011 that burnt 400 homes in the community of Slave Lake (150 km south-east of Peavine) occurred after this study was completed.

Métis traditional burning practices at Peavine

To begin to understand residents' wildfire mitigation preferences, it is important to understand traditional burning practices in the community. Historically, fire was used at Peavine to clear land and fields. This was done by setting fire to the land, or by brush-pile burning, common before 1950. Interestingly, younger participants said the burning of fields to clear land was not practiced at Peavine; however, the majority of Elders interviewed indicated this practice occurred:

A lot of [fires] were caused by people burning hay land. We usually burned out those. But them days, it didn't matter where you burned. There was no forestry then. It was just free-go. [Participant 006, Elder]

This was also verified during participant observation when both field and brush-pile burning were witnessed. Some participants associated the burning of fields with 'cleaning' the land. For example, hay was burned off fields in the spring, so old hay would not be mixed with the new hay.

Fire has been used for grass burning in the spring or fall. Almost all participants had an experience with grass burning, which was witnessed many times during participant observation. Grass burning is conducted in Peavine primarily not to reduce wildfire risk, which appears to have been the case in other Aboriginal communities (Lewis 1978; Lewis 1982), but instead for aesthetic purposes such as removing dead grass from around houses and reducing pests. Using grass burning to mitigate fire risk was identified as an additional benefit. Participants noted sometimes fires got away, but they tended to be small and easy to put out.

Participants reported that burning of the forest did not occur since provincial prevention policies had been enacted and was

^FWe used the intercoder reliability formula recommended by Miles and Huberman (1994): reliability = (number of agreements / (total number of agreements + disagreements)).

discouraged because of fear of an out-of-control fire, fines or imprisonment. A few Elders mentioned their parents used to take care to prevent forest fires. However, there may be gaps to the knowledge on traditional burning currently present in the community as settlement members who would have had extensive knowledge of traditional burning practices may have passed away. However, Elders mentioned that certain subsistence resources were improved after fires, including berry production and availability of moose and deer. Certainly, it can be concluded that fire was a regular part of early settlement life, when fire suppression in remote regions of Alberta was rare, with some traditional burning practices continuing today.

Firefighting

Twenty-seven participants^G had experience with firefighting, and this included approximately 95% of men over 40 and 50% of men under 40. Participants were employed in firefighting anywhere from one to fifty seasons. Some fought fires near the settlement and others were sent as far away as British Columbia, Ontario and California. Strategies for recruitment of wildland firefighters on the settlement have changed over the years. Participants reported that before 1975 fire rangers from the Alberta Forest Service would come onto the settlement and take men to go firefighting. The provincial government legislation at the time indicated men were required to go to fight a fire if they lived within 10 miles (~16 km) of a prairie fire or 15 miles (~24 km) of a grass fire (Stewart 1906):

Nobody wanted to work for 15 cents an hour, that's not very much money. But they ask you first if you wanna go firefighting or else do you want to go to jail until the fire is out. So that's what the deal was. You better be firefighting instead of in jail. [Participant 004, Elder]

Pay was extremely low, but Elder participants expressed sometimes it was the only employment available:

When I first started, that's the only opportunity there was ... there was hardly anything else in earlier times for survival, for jobs. [Participant 040, Elder]

These early firefighters received training from the Alberta Forest Service to be crew bosses, and it became their responsibility to recruit and lead a firefighting crew of 28 from the settlement. Firefighting wages also increased so employment in firefighting could bring significant financial gains. Because of this, some fires in the province were intentionally set to gain employment as job options in other areas for cash wages were severely limited in remote areas. Several settlement members received training and education in forestry from local colleges, and were recruited into firefighting. Women on the settlement also became involved as either firefighters or cooks. Changes to firefighting practices in 1990 by the Alberta Forest Service caused a substantial reduction in the number of firefighters on the settlement. Because of the new training and reduction in crew sizes, most settlement members under thirty do not firefight. In addition, participants commented that now residents had a choice of careers and other opportunities to make money.

Currently at Peavine, there are three crew leaders trained to lead contract crews from Peavine. In the summer of 2010, two contract crews were used, involving 21 community members.

Participants felt they were knowledgeable about fire behaviour and firefighting practices:

I can burn for myself, with the expertise I have, I can burn in any weather. 'Cause I'll know the ground situation, what kind of fuel is available around there. [Participant 007, Elder]

Knowledge of wildfire was transferred amongst settlement firefighters:

When you go firefighting, even when we came home and had a beer together, we'd still be talking about firefighting. We were all doing it, my friends were doing it, my uncles were doing it. Even at the table, they'd be talking about how to work. By the time I went, I already knew the gist of it. [Participant 005]

Firefighters from Peavine who participated in this study had a detailed knowledge of fire behaviour, fire weather and firefighting methods, which were described in extensive detail in interviews and focus groups. This indicates the shift away from reliance on knowledge regarding traditional burning practices to instead relying on knowledge obtained from firefighting experience.

Wildfire experience and support for wildfire mitigation

The results of this qualitative study indicate most participants with fire experience implemented wildfire mitigation on their property and supported wildfire mitigation efforts by the settlement at both the residential and community levels. Our findings show that the type of wildfire experiences of residents influenced why they implemented or supported wildfire mitigation.

Historical traditional burning experience

Four participants, all community Elders (three men and one woman), had experience with both traditional burning and firefighting. When asked to rank the risk of wildfire to the settlement, each of these participants indicated the risk of wildfire at Peavine was low. These participants mentioned most of the settlement had been logged out or burnt over in the last seventy years, reducing the fuel load and lowering the wildfire risk. They noticed since the government had stopped hiring people to fight fires near their communities, deliberate fire ignition (such as arson for economic gain) had decreased; they felt this reduced the risk of fire in the community. They also felt confident in firefighters and available suppression resources being able to stop fires that might affect the community.

These participants were elderly and not able to perform extensive vegetation management on their own property. Instead, they supported the settlement in undertaking wildfire mitigation activities on their properties through various wildfire mitigation programs, such as the Elders Assistance Program (Christianson *et al.* 2012). Fuel reduction was the most common type of mitigation undertaken. However, these participants indicated they allowed fuel reduction on their properties

^GThis includes those listed as traditional burners and firefighters in the next section.

primarily for aesthetic benefits, with wildfire risk reduction being described as a secondary benefit. Participating Elders still perceived the benefits of using fire around the settlement and were not afraid to use fire to burn grass around their homes and clear fields. They felt government restrictions on burning were too tight.

Many of the participants with traditional burning experience perceived a low risk associated with grass fires. This is because they have experienced and controlled grass fires, so they feel they could do the same again:

...any fuel, old dry limbs, any dead logs that have been blown down and stuff like that ... in those area, with tall grass, you might have a fire that will take off on you. But they're really always controllable. [Participant 007, Elder]

Interestingly, although participants with this experience felt the risk was low, most expressed their reluctance to burn for fear of getting in trouble from the province or the settlement for an out-of-control grass fire. The threat of liability for an escaped fire seemed to outweigh the potential benefits of burning.

Firefighting experience

Twenty-four participants had experience with firefighting and no traditional burning experience. Participants in this group ranged in age from 18 to 70 and consisted of 20 men and 4 women. The majority of these participants felt there was a moderate to high wildfire risk in Peavine. Firefighters in the community had seen the power of wildfire and the negative consequences, which influenced their high risk perceptions. Participants with 2 or more years of experience perceived the risk to be high, particularly in the spring:

Because what are settlements? They're just about all bush! And everybody lets their grass grow tall, so one lightning strike, we could lose a whole hamlet. [Participant 029]

Areas identified as being at high risk included the 'young hamlet' area of the community where there is an abundance of spruce and Big Foot Park, a recreation area in a pine forest that has numerous dead trees from mountain pine beetles^H.

Participants with firefighting experience felt some factors heightened the risk of wildfire to Peavine. They mentioned Peavine was very dry from 2008 to 2010^I:

We had a dry summer, a dry fall and we're having a dry winter. Our fuel is getting drier all the time... If you study out in the forest, a spruce, the tips of them are just brown... [There's] just no moisture for the spruce. That's why there's more risk now for fire. It's easy to flare-up any size of fire. [Participant 040, Elder]

Some participants in this group felt forests on the settlement were growing out of control, increasing the wildfire risk. A few of these participants said current prescribed burning efforts by

the government were not burning enough forest to reduce the wildfire risk and directly linked wildfire to improving forest health and reducing wildfire risk.

However, there were some factors that participants with firefighting experience felt lowered the wildfire risk to the settlement. They noted firefighting knowledge and experience of Peavine members lowered the wildfire risk. They also said the grass and aspen trees surrounding many of the homes, the number of small lakes, streams and rivers, and the work of the forestry coordinator on the settlement, lowered the risk. The only risk they mentioned was people being careless with fire.

Seven participants mentioned they cut back brush and other vegetation, mowed lawns, removed dead vegetation and thinned trees in the forest around their home:

If you take all the underbrush out ... it will reduce getting the house on fire, because it will only come so far and that's it. And anybody could start a grass fire [accidentally]. [Participant 039]

This was verified during trips to participants' homes. When asked if these activities were undertaken strictly for wildfire mitigation, the majority indicated vegetation management also had an aesthetic benefit.

All 24 participants with firefighting experience supported the settlement-led mitigation program, and had allowed the settlement to conduct vegetation management on their own properties. This support is probably partly due to their knowledge of wildfire mitigation. When firefighting crews are on standby when working for the provincial government, they are given wildfire mitigation tasks around the area where they are stationed. The firefighters are also able to see how wildfire mitigation activities affect fire behaviour and reduce risks to communities and homes. Extensive firefighting experience in the community made wildfire mitigation easily accepted on the settlement. A few firefighters with multiple years of firefighting experience were worried that not enough was being done by members to reduce the wildfire risk, and felt there were easy steps that could be taken to significantly reduce wildfire risk. Most participants in this experience group seemed to see taking such steps in their community as common sense:

I mean, sure we clean brush and put anything back away from the house. And I do know about fire prevention, we did a bit of that last week [on community projects]. It's minor stuff. I thought all that was common sense, right? [Participant 009]

Participants with firefighting experience felt wildfire risk had been significantly reduced in the recreation areas of the settlement through community-level mitigation programs. They noted the clearing of underbrush, the spacing and pruning of trees, the provision of firewood, and the building of fire pits and gazebos now meant a fire was less likely in these areas. However, many in this group were knowledgeable about mountain pine beetle and that it had killed pine trees in settlement

^HClimate change has resulted in the mountain pine beetle making a historic transition into the boreal forest of Northern Alberta (Carroll *et al.* 2006), where fire suppression has resulted in an increase of mature pine trees susceptible to the beetle (Parker *et al.* 2006). The result is that beetle-killed trees present on the landscape have increased fire hazard to Aboriginal communities in the province, such as Peavine.

^IThese observations are supported by annual climate data from Environment Canada (2011), which indicates that 2010 was the warmest year in Canada on record and that Northern Alberta received 20% less precipitation than usual.

forests. Participants felt to lower the wildfire risk to recreation areas, beetle-killed trees must be cut down and burned.

Interestingly, structural mitigation options^J were not brought up by any participants with firefighting experience. It is unknown whether this was because they felt structural mitigation was already in place on most settlement buildings or because they were unaware of structural mitigation options. Land tenure and home ownership also affects the implementation of structural mitigation measure by individual settlement members, as all homes and land on the settlement are owned by the settlement council, which complicates wildfire mitigation (Christianson *et al.* 2012). Most homes on the settlement have vinyl siding and asphalt shingles, and through participant observation and discussions with settlement staff these decisions were made based on cost. Participants in this group also expressed one of the most important ways to reduce wildfire risk was through the re-establishment of the Peavine Volunteer Fire Department. Most firefighters felt wildfire was not 100% preventable and there would always be a human-caused grass fire or a lightning-caused wildfire annually on the settlement. They felt having a fire truck and trained firefighters would help to stop a wildfire from causing major damage on the settlement.

Bystander experience

Twenty participants had bystander fire experience, thirteen of which were women between 18 and 83 and seven were men under 30. These participants did not have experience with firefighting, but had directly experienced a wildfire by using traditional burning practices (such as burning grass in fields and around homes), seeing a wildfire or experiencing smoke from a wildfire. Although they have seen many wildfires in Peavine and surrounding areas, the consequences of these wildfires have not been severe. This experience may cause bystanders to perceive a lower wildfire risk than firefighters in the community. Many participants in the bystander group relied on the knowledge of firefighters for help with preventing a wildfire or putting out a fire:

If it was kind of small, I'd try to do something about it myself. But if it was anything serious, then I would get people that know more about it than I do. [Participant 014]

Participants with bystander experience commented that there are lots of lakes and streams in Peavine, reducing the risk. Some felt their risk was reduced because of large grass areas around their homes. Others' homes were surrounded by muskeg^K, which they also felt substantially reduced the risk of fire. All participants in the bystander experience group commented that

they felt Peavine was drier now than it had been in recent years which increased the perceived risk.

Six participants with bystander fire experience undertook wildfire mitigation activities on their properties primarily for reasons other than wildfire mitigation, but acknowledged the activities also helped to reduce their wildfire risk. Some participants in this group commented they cut back trees to reduce the risk from windfall, with the secondary benefit of reducing potential fuel for a wildfire. Two participants in this experience group commented that their extended family members who were firefighters had initiated vegetation management on their property, because the former firefighters were concerned about wildfire risk:

My father-in-law [a firefighter] actually went and took out a lot. He was thinking not only for fire but the windfall. It was just getting a little too close to our home. So he bucked up all the trees and took out a lot, so we're pretty open up now. [Participant 037]

Therefore the social influence of family members who had firefighting experience encouraged the implementation of wildfire mitigation.

The rest of participants in this group undertook mitigation activities to improve aesthetics, but did not relate this to reducing wildfire risk. They explained they cut or burned grass around their home for aesthetic reasons and also to reduce pests, not to reduce wildfire risk. A few participants burnt their fields, with the main benefit being improved crop production.

All participants in the bystander group had agreed to participate in the settlement-led mitigation program by allowing the settlement crews to clear vegetation on their properties. These participants said they agreed to the program for reasons related to general property maintenance, not reducing wildfire risk:

Actually I did [agree to participate]. But it wasn't because of [wildfire], it was just 'I agree, go clean it up'. [Participant 030]

Many in this group said they supported community-level mitigation but that they were unaware of specific wildfire mitigation activities currently occurring on the settlement.

Discussion

Participants had a variety of experiences with wildfire: some had engaged in traditional burning, many were firefighters and many had seen a wildfire in their community or nearby. Our results show that how residents had experienced wildfires affected why they implemented certain mitigation strategies (Table 1).

Table 1. Summary of how wildfire experience influences instigation of mitigation activities at Peavine Métis Settlement

Experience type	Implementation of residential mitigation	Support of settlement mitigation programs	Primary reason implementing or supporting mitigation
Historic traditional burners	yes	yes	aesthetics and wildfire mitigation
Firefighting	yes	yes	wildfire mitigation
Bystander	yes	yes	aesthetics

^JExamples of structural mitigation options include using fire-resistant siding, triple pane windows, soffit screens and metal roofing material.

^K'Muskeg' is a word of Cree origin, which now refers to a treed bog.

Traditional burners had implemented or supported wildfire mitigation for reasons related to both wildfire risk reduction and aesthetics; firefighters were more concerned with reducing wildfire risk; and bystanders were ultimately interested in improving aesthetics.

There are similarities between the findings of this study and those of Carroll *et al.* (2010) amongst Native Americans in the Pacific Northwest and by Monaghan (2004) amongst Aborigines in Northern Australia. Peavine residents indicated they found implementing residential wildfire mitigation activities to be common sense, similar to Monaghan's findings that wildfire mitigation activities were a normal part of life in the two Aboriginal communities he observed. Participants from Peavine had experience with traditional burning and firefighting that have combined to result in a new wildfire knowledge base for the community that increased support for community-level mitigation, similar to the hybridisation of knowledge found by Carroll *et al.* (2010).

Our findings contrast with the results of existing research that examines the link between recent wildfire experience and mitigation preferences. Researchers involved in several studies in non-Aboriginal communities found that fire experience did not affect whether or not residents implemented residential mitigation activities (Winter and Fried 2000; Nelson *et al.* 2004; Vogt *et al.* 2005; Martin *et al.* 2009) or supported community-level mitigation (Nelson *et al.* 2004; Vogt *et al.* 2005). An explanation of this difference is that these studies in the US included participants who appear to have experienced one major wildfire event, as opposed to residents at Peavine who experienced numerous wildfires of varying size, severity and scale. The findings of our study are similar to Vogt's (2003) study in non-Aboriginal communities. She found that wildfire mitigation preferences differ depending on the type of wildfire experiences of residents. Participants in Vogt's study had complex and varying wildfire experiences. This is similar to Peavine, where participants had experienced fire in many ways over an extended period of time.

A small group of researchers in Canada examined how different wildfire experiences affect the adoption of mitigation measures. McGee *et al.* (2009) found that differences in residents' experiences during a wildfire (losing a home, being evacuated, self-evacuating early, staying in their house during a wildfire or being away from the area) affected how residents perceived wildfire risks and their adoption of mitigation measures on their property 1 year after a fire. We also found that different types of experiences affected mitigation preferences, however our study examined the wildfire experiences of Aboriginal people, the role of long-term and contemporary fire experiences, and how experiences influenced both mitigation completed by homeowners and support for mitigation at the community level.

Conclusion

This study has important management implications for the creation and implementation of wildfire mitigation programs in Aboriginal communities. The results of this study show extensive fire experience present at Peavine sensitised residents to the importance of wildfire mitigation, which made it easier to gain

support for the settlement-led mitigation program. The type of wildfire experiences that Aboriginal residents have may affect support for particular types of wildfire mitigation. For example, a community still heavily influenced by traditional burning may favour mitigation strategies that incorporate traditional burning practices to mimic natural fire, such as prescribed burns (Carroll *et al.* 2004). A community with a high number of firefighters may prefer vegetation management, as was the case at Peavine where many of the community leaders were former and current firefighters. A community where the majority of residents have only experienced fire as bystanders may favour mitigation strategies that focus on the other benefits of wildfire mitigation, such as forest health and aesthetic benefits.

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