Cariboo-Chilcotin Agriculture/Wildfire Preparedness Project

Opportunities and Barriers to Wildfire Risk Mitigation

Prepared for

BC Agriculture & Food Climate Action Initiative

Cariboo Cattlemen's Association

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Statement of Limitations

This report has been prepared by Compass Resource Management Ltd ("Compass") and its partners for the exclusive use and benefit of Cariboo Cattlemen's Association ("Clients"). This document represents the best professional judgment of Compass and our partners, based on the information available at the time of its completion and as appropriate for the scope of work. Services were performed according to normal professional standards in a similar context and for a similar scope of work.

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Executive Summary

Between March 2015 and June 2016, Compass Resource Management, B.A. Blackwell & Associates, and H. Bayliff engaged ranchers in the Cariboo-Chilcotin region in a planning process to identify the opportunities and barriers to more effective wildfire risk management on ranchland properties in the Cariboo region of British Columbia, and to pilot an approach to addressing that risk. This document focuses on the outcomes of individual ranch visits and more widely attended workshops designed to initiate discussions on the opportunities and barriers to implementing wildfire risk management strategies. More specifically, we sought feedback on the topics of fuels management near high-value areas, and structural protection in the event of wildfires.

There are many opportunities for range tenure holders to apply for permits to cut trees in the vicinity of fence lines and other ranch infrastructure under the Forest and Range Practices Act and the Range Planning and Practices Regulation. However, two important barriers were identified:

- Ranchers' time is limited, and fuel mitigation is unlikely to rise to a high priority level for most ranchers in most situations.
- The need to dispose of fuels (rather than leave them on the ground) limits ranchers' options for permits to cut fuels, and more importantly, presents a serious liability concern for the most cost-efficient method of fuel disposal, which is pile burning.

The major opportunity in terms of structural protection in the event of fires was related to sprinkler protection units (SPUs). These units could be purchased, maintained, and operated by local cattlemen's associations. For this opportunity, there were also two key barriers identified in the workshops:

- Cost could be a barrier, but the exact cost will depend greatly on the design of the units. An individual ranch may not be able to afford a full kit to protect their ranch (at a cost of $23,000), but a set of 3 kits to be deployed in emergencies (at a cost of $72,000) might not be out of the question for a cattlemen's association.
- A great deal of planning effort is needed to ensure that the SPUs are used correctly and maintained well. In addition, detailed operating guidelines that dictate who is responsible for the SPUs, where they are kept, and how they are deployed are critical to their successful use in an emergency situation.

To make progress toward tackling these barriers, we provide the following insights:

- Without financial incentives that provide them with the flexibility to do the work themselves or to hire others, ranchers as a group are unlikely to make progress toward reducing fuel loading across their ranges.
- Ranchers would benefit greatly from help to develop detailed fuel treatment prescriptions that make smart use of the available policy options, and simultaneously provide landscape scale benefit through the development of landscape-scale firebreaks.
- Technical and financial support to aid the development of detailed operating procedures could prove critical to ensuring that the SPUs get used properly over time.

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1 Introduction

The Cariboo-Chilcotin region experiences wildfire on a regular basis. Because ranchers there are often geographically isolated and because their ranch assets are distributed across a fire-prone landscape, the ranching community in the region is, in general, exposed to a high level of risk. Between March 2015 and May 2016, Compass Resource Management, B.A. Blackwell & Associates, and H. Bayliff engaged ranchers in the Cariboo-Chilcotin region in a planning process to identify the opportunities and barriers to more effective wildfire risk management. The project was led by the Cariboo Cattlemen's Association in partnership with the BC Agriculture and Food Climate Action Initiative, the Ministry of Agriculture and other partners, with four broad goals:

1. Minimize the damage to agricultural productivity and agricultural infrastructure associated with wildfire events,
2. Strengthen (agriculture-specific) information and resources to assist producers with wildfire mitigation, preparedness and recovery,
3. Improve collaboration to support agriculture with wildfire preparedness, mitigation and recovery,
4. Identify costs, issues and barriers around implementation of mitigation and preparedness measures.

The process we used to accomplish these goals is unique in that it maintained focus simultaneously on ranchers' values – the things that are important to them and to their businesses – and on a deep understanding of forest condition and wildfire behaviour.

The project resulted in four primary deliverables:

1. A summary of wildfire-related resources relevant to preparedness, mitigation, and recovery actions for ranches,
2. A ranch-level wildfire preparedness planning template to provide guidance to other ranches in the Cariboo-Chilcotin in preparing for and mitigating the risk of wildfire,
3. An evaluation of the policy opportunities and barriers to more effective wildfire risk mitigation activities for ranches, based on research, information provided by the project sponsors and input gained in the process workshops, and
4. A summary of the transferable planning process to help guide similar planning processes in other regions.

Our approach to this kind of problem separates the two components of risk – the likelihood and the consequences of a wildfire. Considering these two elements separately and in all of their possible combinations (e.g., low likelihood and low consequence vs. low likelihood but high consequence) not only allows us to differentiate between different kinds of risk, but also allows us to consider strategies for reducing risk that match the type of risk itself (Figure 1). Different combinations of levels of likelihood and consequence imply different strategies for reducing risk. For example, when a wildfire is unlikely and the consequences should one happen are not important (lower left, left side of Figure 1), then any effort to further reduce the risk is probably

not warranted (right side of Figure 1). On the other hand, if the consequences or the likelihood (or both) are high, then taking some sort of action to reduce the risk makes more sense.

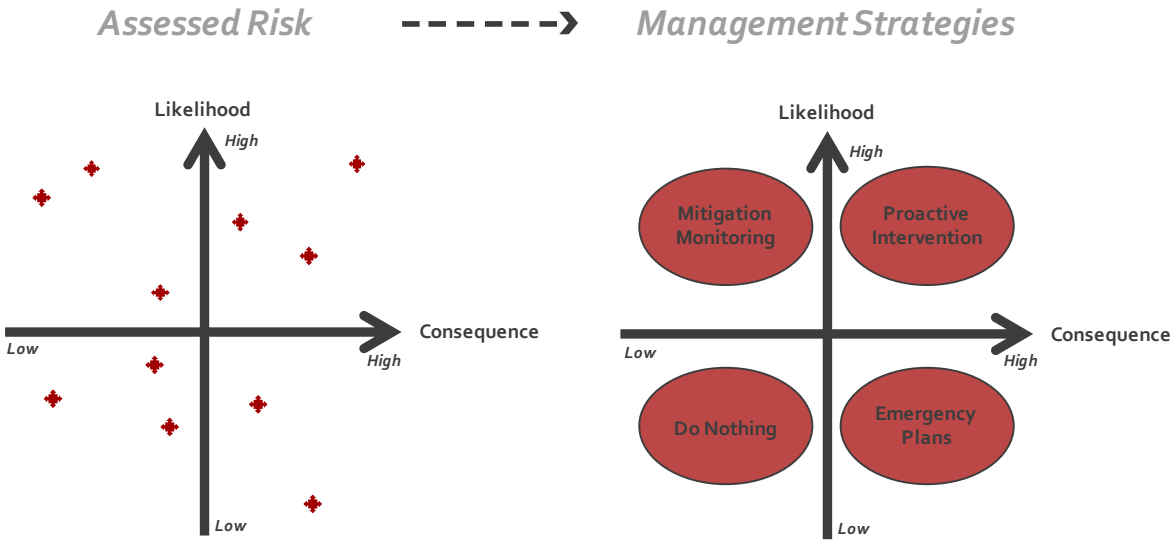

Figure 1. Risk is a product of the likelihood and consequences of a fire, each of which can be expressed along a continuum of low to high (left). Different combinations of levels of likelihood and of consequence imply different management strategies (right).

1.1 Identifying Appropriate Management Actions

Even with the conceptual guidance suggested by figure 1, implementing a management action still requires choices about what to do, as well as when, how, and where to do it. For example, fuel reduction treatments are a good tool for reducing the likelihood of a wildfire, particularly when done close to high-value areas (Table 1). However, choices need to be made about which fuels should be removed, over what schedule, and where on the landscape.

Table 1. Example management actions that fall within each risk management strategy shown in Figure 1.

Proactive Intervention	- Large-scale fuel reduction treatments - Prescribed burns - Fire breaks around important infrastructure - Replace vulnerable building materials
Mitigation & Monitoring	- Small-scale opportunistic fuel reduction treatments - Monitoring fire likelihood (e.g., updating fuels maps) to know when to trigger more active approaches - Equip ranch staff with basic fire tools to extinguish small fires on the property
Emergency Planning	- Insurance - Sprinkler Protection Kits - Evacuation Plans - Certify ranch employees in S100 training.
Do Nothing	- No actions

In all cases where the probability of wildfire is high, choosing management actions from the spectrum of possibilities should reflect the scale of the values at risk. High value areas with

critical infrastructure should receive management actions commensurate with that value. Likewise, areas with lower value assets should receive less and less intensive actions, again commensurate with the scale of the value.

Starting down the path toward good choices of management actions requires understanding what the opportunities and barriers to the various options are for those, including which actions are within the scope of control of the decision maker – in our case, ranchers in the Cariboo.

This document is the third of four deliverables, which focuses on the outcomes of individual ranch visits and more widely attended workshops designed to initiate discussions on the opportunities and barriers to implementing management strategies that match the nature of risk that the ranching community faces in the Cariboo.

2 Gaining insights into opportunities and barriers

In the fall of 2015, we worked with seven ranches across the Cariboo-Chilcotin Region to perform more in-depth assessments of the sources of risk to their ranches, and also to discuss some of their concerns with various options for risk management. Two options included fuels management near high-value areas of their ranch, and structural protection in the event of wildfires.

In addition to these visits, we held two workshops, one in Tatla Lake and one in Williams Lake, to get feedback from a wider audience on the same topics. These workshops were attended by representatives from The Cariboo Regional District, the Wildfire Services Branch (WSB), and the Ministry of Forests, Lands and Natural Resource Operations Range Office. In addition, each workshop had between 15 and 18 ranchers from the local communities. This attendance provided a diversity of perspectives and experience related to wildfire and wildfire management.

In each workshop, we first provided a brief review of the lessons we learned from our analyses and our ranch visits. The major lessons from that phase of the project were that most of the risk to the high value parts of the ranch – the ranch headquarters and the network of fences – is from high fuel loads in the tenures. Additionally, the seven ranches that we visited had done the things necessary to comply with BC FireSmart guidelines, which effectively reduces the likelihood of fires in the main ranch areas. Therefore, according to Figure 1, the appropriate strategies would be to focus on proactive intervention and mitigation in the tenure and emergency planning for the main ranch areas. In addition, Table 1 suggests appropriate actions within each category. Rancher interest that was expressed during the first round of workshops and during our visits served as the basis for selecting particular management actions from Table 1 as candidates for further discussion.

The bulk of each workshop was devoted to discussing the opportunities and barriers to proactive intervention options such as fuel reduction treatments near main ranch areas and fence lines, and to emergency planning options such as sprinkler kits for building protection in the event of a fire. The sections below describe the outcomes of these workshops.

3 Proactive intervention to reduce wildfire risk on rangelands

In general, we consider the purpose of proactive interventions to be to reduce the likelihood of a wildfire in high value areas, rather than to reduce the consequences (by removing fences, for example, or moving buildings). This generally occurs by eliminating problematic fuels though a fuel treatment plan. However, because in general ranchers don't have rights to the timber in their grazing tenure, many ranchers expressed some uncertainty about their options for reducing fire risk.

The following two sections describe the major opportunities for fuel reductions for ranchers, and then some of the major barriers to implementing those options.

3.1 Opportunities

There are many opportunities for range tenure holders to cut trees in the vicinity of ranch infrastructure under different regulations such as the Forest and Range Practices Act and the Range Planning and Practices Regulations. However, any cutting of timber under any regulation requires a permit approved by the FLNRO District Resource Manager.

Reducing fuels around new and existing Crown fence

If the Crown fence is a new fence, then the entire right-of-way (ROW) is likely to be authorized with a 5-metre ROW; the approximate width needed for a quad and driver to be driven on either side. If the new Crown fence is constructed in a stand that is grey attack, for example, the range tenure holder could get authorization to make the ROW a tree length on both sides. A grey attack stand is a forest stand with a majority of trees killed by insects; this phase generally begins five to seven years after the forest is killed. This tree length distance provides for the protection of the fence from the real potential damage from windthrown dead trees. This only applies to those trees that are dead and may threaten the Crown fence. In the case of future maintenance of the fence in a grey attacked stand, the tenure holder would only be able to maintain a 4-meter ROW width with these legal authorities. No timber mark and no stumpage would be charged if the trees were left on site, though leaving these fuels in place reduces the benefit to wildfire risk.

In the case of existing Crown fence, the range tenure holder could also apply for a permit under Section 52 of FRPA to cut fuels if that fence existed within a stand of trees that were threatening the Crown fence, e.g. an insect infested patch or large area with a number of trees that could fall and damage the Crown fence. Similar to the example above; the ROW could then be a tree length on both sides and would apply to dead trees of any diameter. No timber mark and no stumpage would be charged if the trees were left on site and properly disposed of. If a permit was requested by a range tenure holder the specifications for a tree length ROW on each side would need to be in writing and signed by the District Resource Manager.

Figure 2. This tenure area near ranch infrastructure shows high fuel load on the ground (fallen dead), and high numbers of understory trees that can act as ladder fuels. These sorts of areas may be good candidates for fuel management actions.

Reducing fuels near ranches, corrals, and other high value areas

An authorization under Section 52 of FRPA should be used where the project involves little or no merchantable timber and the timber will not be sold. Applying for the Section 52 is rather simple from the range licensee standpoint and involves sending a letter of request for a Section 52 (including an attached map and plan for treatment and fuel disposal) to the District Resource Manager.

Range licensees are allowed to cut damaged or destroyed timber where there is clearly no commercial harvesting opportunity, after sending a letter of request (including an attached map and plan for treatment and fuel disposal) to the District Resource Manager. The timber must be of such poor quality that it cannot be sold for any purpose once it has been harvested. This includes small piece size, branches, brush, dead, deteriorating, damaged or understory trees, etc. This form of authorization is to be used to approve activities such as pruning, spacing, piling and burning and chipping of timber. In some circumstances there may be small merchantable volumes interspersed with the non-merchantable timber. It is suggested that a small volume ($50m^3$) of merchantable timber may be cut, damaged or destroyed under this option. However, it is recognized that certain situations will warrant exceeding this suggested maximum. If this small amount may be exceeded, the District Resource Manager must be informed and the project re-evaluated. Generally, the timber will not be removed from the site. However, an exemption can be provided in the case where the timber needs to be removed for fire hazard purposes and will not be sold to someone else (i.e., removed to a central location for disposal). This removal requires a written exemption by the District Resource Manager.

A free use permit (under the Forest Act) could be used where the merchantable volume involved is less than 50 m^3 and where the timber will not be sold. The purpose of this permit is to allow the range licensee to use the timber for agricultural or personal use such as fence improvements and firewood. This likely applies to single or small groups of low value trees. This free use permit is likely to be particularly useful for Crown timber that is near privately owned ranch infrastructure such as private fences, corrals, and buildings. In contrast, the regulations described above normally apply to Crown assets such as Crown fence. The main application of this option will be to authorize personal firewood cutting (not for commercial purposes), and could target live and dead trees of any size. The number, size class limits and volume (m^3) would have to be negotiated in the permit with the Ministry of Forests, Lands and Natural Resource Operations.

Disposing of fuel

BA Blackwell has recommended debris management options like chipping, lop and scatter, and outright removal by truck. The most appropriate debris disposal method depends on which fuel management / tree cutting option(s) are chosen, which in turn depends on the amount of fuel, cost effectiveness of the treatment, and operational constraints. The following are some debris management options:

1. Chip or Drag and Remove (CDAR) – the chipping and dragging of debris and removal from the treatment site for disposal. This debris management method can be applied in any fuel type or treatment type when there is good access and removal of the majority of surface fuels is possible. This is generally recommended when vehicle access is within 50m. Dragging refers to dragging debris to a machine, such as a chipper or air curtain burner, for disposal.

2. Chip and Leave (CAL) – the chipping of debris and distribution of debris on the site. This debris management method may be utilized following a hazard tree removal treatment when surface fuel load is low and the amount of debris being chipped is minimal. In the course of our discussions, some ranchers expressed concerns over chipping fuels (particularly where there is lots of debris to chip) and leaving them in place, citing past experiences where the chips damaged cows' feet. It's unclear whether this is a consistent problem or only for some situations.

3. Pile and Burn (PB) – The use of either small (1.0m x 1.0m) campfire piles or larger industrial piles to burn and dispose of debris. This method can be implemented in all fuel types and on sites where access is limited or sites are isolated. However, there is considerable liability and planning with advice of a professional is advised. Section 7.1 in the Appendices provides detailed information on regulations that pertain to pile burning.

3.2 Barriers

The most consistent barrier to conducting fuel treatments that ranchers at the workshops identified was time availability. Over the course of the two workshops, responses to questions about whether ranchers would make the time to take advantage of these opportunities were mixed, and also varied by location. In the Tatla Lake meeting, most ranchers voiced that for a few key areas, spending the time to reduce fuels would be a high priority, even though most felt

it was not economically justified. In the Williams Lake meeting, however, the response was more mixed – about half were appreciative of knowing what their options were, but felt it was unlikely that fuel reduction would ever rise to the top of their priority list.

Even when we asked whether fuel treatment activities would become a priority if the ranchers could be paid for their time, the responses were similar. For some, being paid would enable those activities to become high priorities, but for most of the ranchers in attendance, the limiting factor was time rather than compensation. Some participants noted that having consistent funding opportunities, rather than one-time opportunities, would better enable making regular progress on fuel mitigation work. In addition, having access to large machinery and other ways of reducing the amount of time spent thinning fuels was attractive to some participants, but wasn't identified as a primary barrier to prioritizing fuel reductions.

The need to dispose of any fuels that are cut from fence ROWs and from areas near ranches pointed to another significant barrier. The most cost efficient method of disposing of fuels is pile burning, as described above. If done poorly, however, burning debris can lead to escaped fires and large scale damage. There are clear regulations for when burning is a viable option (see appendices, section 5.2), but the consequences of causing damage are serious enough that many ranchers said they would not engage in fuel reduction practices because of the fear of being held liable from starting a fire. Several possible ways of reducing the risk of liability came up for discussion, most notably including templates for documenting and recording due diligence on the part of the ranchers to fully extinguish pile burn locations.

4 Emergency planning for ranches in the Cariboo

Even with the best mitigation actions, the risk of wildfire cannot be fully eliminated. Therefore, planning for emergencies is a critical part of reducing the impact of wildfires over the long term. In addition, all of our ranch-level assessments showed that because the ranch areas generally conform to FireSmart guidelines, the risk of direct wildfire impacts on the ranch headquarters is relatively low, while the consequence is extremely high. According to figure 1, the most appropriate management action under these conditions is emergency planning.

4.1 Opportunities

Following the devastating 2003 fire season, a review of British Columbia's response to interface fires was established by the provincial government and carried out by the honourable Gary Filmon. This review found that BC could do more to be better prepared for wildfire emergencies (Office of the Auditor General, 2005). Firefighters often do not have the resources to protect every structure in danger of an oncoming wildland fire. Homeowners must, therefore, plan on protecting themselves. In addition to increasing awareness through the FireSmart initiative, the Filmon Review recommended that homeowners invest in "methods of self-protection such as sprinklers as soon as possible (Filmon, 2004)."

In 2004, the Union of B.C. Municipalities acquired provincial funding and technical advice from the Office of the Fire Commissioner (OFC) and the BC Wildfire Service (BCWS) to develop and assemble Sprinkler Protection Units (SPUs) (Merson, 2006). These SPUs are trailers containing the components to install sprinklers to structures at risk from interface fires. The SPUs are

owned by the UBCM, stored and maintained by the BCWS, while deployment, training, and public education are managed by the OFC. Deployment is triaged to the structures that are most vulnerable to approaching fires (Merson, 2006).

Figure 3. Example of a sprinkler used on a rooftop to protect the building from ember showers. Photo credit: Small Farm Services, Australia.

According to the OFC, setting up structural sprinklers is the easiest step in making a property Fire Smart and is over 90% effective in saving structures from wildfire (Ree, 2016). The sprinkler method works by wetting surfaces and slowing the advance of fires by creating a humidity dome around the structure and property. Moisture in the air is increased in the immediate area, lowering the ambient temperature sufficiently below the ignition temperature of ember showers from nearby fires. The likelihood of combustibles igniting is also decreased (Ree, 2016).

The OFC recommends a minimum wetting time of two hours prior to the fire reaching the property for full saturation and effectiveness (Ree, 2016). To reduce set up time, smaller components such as sprinklers, mounts, and brackets can be put in place at the beginning of the fire season, or left permanently installed. With the smaller components in place, hoses and pumps will be laid out and connected (Figure 1) (Swart, 2016). Depending on the pump, a 3000 gallon bladder will take about ten minutes to fill. The sprinklers should not be turned on until necessary as there may be a shortage of water in the area (BC Wildfire Service, 2009). A list of components and specifications is given in Tables 1 and 2, in the Appendix (Section 7.3).

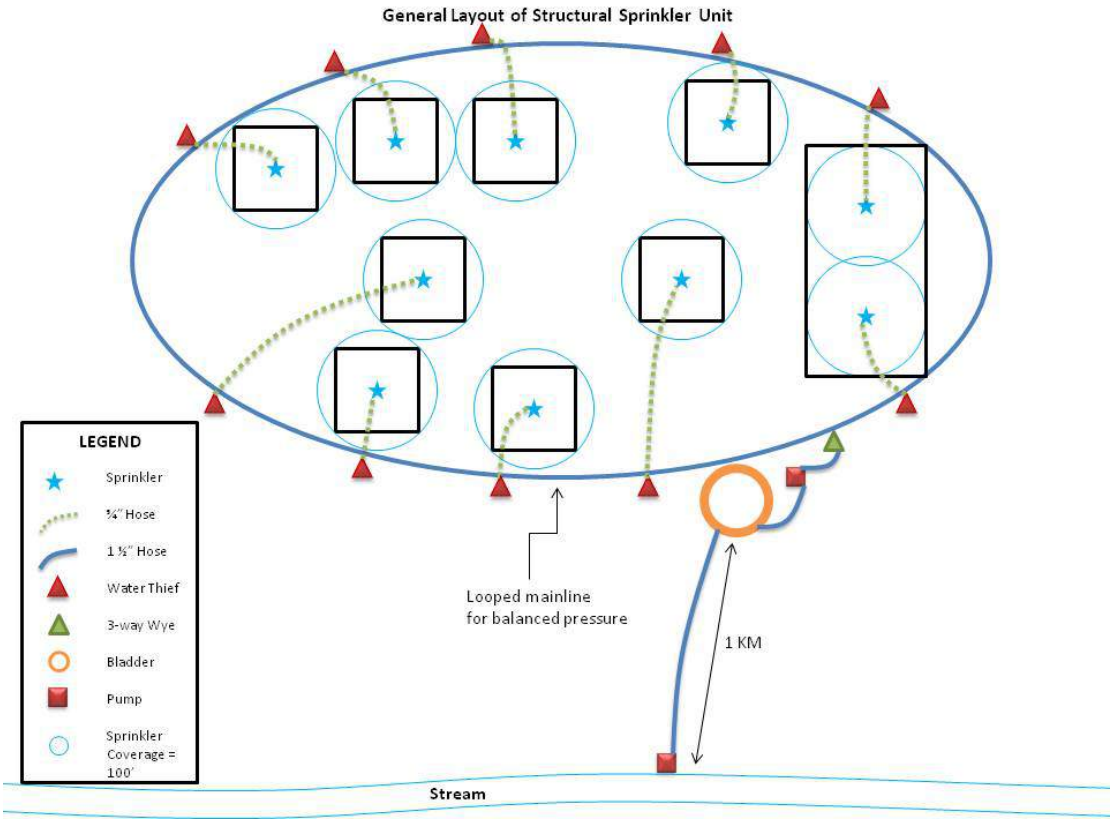

Figure 4. A schematic of components and general layout for a sprinkler unit setup on a rural property. Structures are represented in the figure by black rectangles. (Swart, 2016).

Generators

Loss of power is a common problem during an interface fire. A backup generator is necessary to maintain a water supply from sources that rely on electric pumps. Available power can also aid in firefighting efforts, as well as for post recovery.

An electrician can assess a property to calculate its essential load in the event of a power failure. Generally, a typical home will require a 10 kW generator to power essentials such as lights, refrigerators, security systems, and communications for several days. Larger generators from 20 to 25 kW can generally restore full power to a household for several days (Poetker, R., 2016).

Standby generators are permanently installed on the property and connected directly to the electrical panel. They can run on natural gas, diesel, or propane (Poetker, L., 2016, see table 3 in the Appendix, section 7.3). Natural gas is the most economical fuel supply for generators under 40 kW and also more convenient as the gas is piped in beneath the ground. An assessment will be required to determine whether natural gas is available on the property. Diesel and propane require an external tank which must be refilled (Poetker, R., 2016). Portable generators that run on gasoline generally provide smaller wattages and are less dependable because of their smaller fuel reserves.

4.2 Barriers

Cost was identified as a barrier to assembling SPUs as outlined in table 1 (section 7.3) for many individual ranches. However, all of the workshops participants felt that the cost of collectively owning resources like this, potentially through local cattlemen's associations, lowered the cost barrier. For some individual ranches that are particularly remote or whose assets are particularly distributed over a large area, however, owning a sprinkler protection kit might be worth the cost, because it might not be possible to deliver a sprinkler kit in an emergency.

A much larger barrier identified in the workshop is the logistical coordination required to operate shared emergency response resources. There are several key considerations related to management and operation that are important to understand before purchasing a set of sprinkler kits. Most importantly, identifying who is responsible for maintaining the kits and what regular maintenance is required, establishing a program to train people to set up and use the kits properly, and developing a set of operating procedures that dictate where they are kept and how they are mobilized in an emergency. Participants at the workshops differed in their response to the degree to which these were surmountable.

At the Tatla Lake meeting, where many of the participants are actively involved in the community Search and Rescue group and also regularly work on or in support of fire crews during the fire season, workshop participants felt that these barriers were important but not insurmountable, as many people in that community have experience with similar operation procedures. At the Williams Lake meeting, however, many people felt that coordinating the use of sprinkler kits in the eastern end of the region would be particularly difficult because of the higher number of ranches, and because those ranches are not as often distributed along major highways as in the western end of the region.

5 Conclusions and next steps

Based on the results of our work, we are confident that the two risk management approaches that will provide the greatest potential for reducing wildfire impact to the ranching community in the Cariboo-Chilcotin Region are (1) active fuel reduction treatments in key high-value areas, and (2) emergency planning initiatives that fill gaps in the ranching community's ability to protect themselves. The workshops did identify barriers to the implementation of actions to address these strategies, but we believe that they are, in large part, surmountable.

The need for financial incentives to allow ranchers to make fuel management a priority is fairly clear. Without financial incentives that provide them with the flexibility to do the work themselves or to hire others, ranchers as a group are unlikely to make progress toward reducing fuel loading across their ranges. However, even if these sorts of incentives were available, ranchers would also benefit greatly from help to develop detailed fuel treatment prescriptions that make smart use of the available policy options. If done at one time across many ranches, these prescriptions could potentially provide some landscape level protection through the development of firebreaks at critical points in the landscape, which would provide additional benefit as well.

Though funding sources to assist with the cost of sprinkler protection units might lower the barrier to cattlemen's associations, technical and financial support to aid the development of detailed operating procedures would also prove helpful for any organization that owns and manages the SPUs. These sorts of guidelines and procedures are critical for ensuring that the SPUs get used properly, and well-executed planning documents often fall through the cracks.

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7 Appendices

7.1 Regulations on Pile Burning

In British Columbia, the Wildfire Act and Regulation specifies the legal obligations when using fire in, or within one kilometer of, forest land or grassland. More detailed regulations for open fires can be found in the FNLRO "Industrial and Resource Management Burning Brochure" (2014).

Category 2 open fire is a fire that:

- Burns material in one pile not exceeding 2 m. in height and 3 m. in width; or,
- Burns material concurrently in 2 piles each not exceeding 2 m. in height and 3 metres in width; or
- Burns stubble or grass over an area that does not exceed 0.2 ha,
- Is not a campfire.

A burn registration is number is not required for Category 2 open fire.

Category 3 open fire is defined as a fire that burns:

- Material in 3 or more piles, each not exceeding 2m in height and 3m in width,
- Material in 1 or more piles each exceeding 2m in height and 3m in width,
- One or more windrows, or
- Stubble or grass over an area exceeding 0.2 hectares.

Category 3 open burns require a burn registration number, obtained by phoning the Ministry (1-888-797-1717). Anyone that undertakes burning of a Category 3 open fire must comply with the Environmental Management Act and Open Burning Smoke Control Regulation (OBSCR). This requires individuals to check local venting conditions prior to ignition and to ensure that no air quality burning bans are in place. More details: www.env.gov.bc.ca/air/airregs.html.

The OBSCR prohibits burning within 150m of an occupied structure (if forced air technology is used, or 500m without), and within 500m of a school grounds, hospitals and continuing care facilities (if forced air is used, otherwise 2km if not).

Open fires for range improvement are considered 'resource management open fires' (see above) under the Wildfire Act.

A resource management open fire is:

- Burning unpiled slash over an area of any size
- Is not a campfire, Category 2 or 3 open fire, and is lit, fuelled or used for silviculture treatment, forest health management, wildlife habitat enhancement, ecological restoration or range improvement.

Category 3 and resource management open fires can only be lit and fuelled if:

- There are no other restrictions in place for doing so;
- Doing so is, and will continue to be, safe;
- The person submits a burn plan to an official and receives the official's approval to it in writing;
- The person obtains a burn registration number for the fire;
- The person takes all the necessary precautions to ensure the fire is contained in the burn area.

It is largely up to the contractor to ensure compliance with all regulations; however, the prescription writer can place certain restrictions on them to safeguard some aspects of the burn. For example, maximum pile size can be written into the prescription.

7.2 Consequences of violating cutting permits or Wildfire Act provisions

Administrative Penalties (FRPA Administrative Orders and Remedies Regulation):

Part 3, Division 2, Section 13 - Unauthorized forest or range activities:

Section 13(2):

- The maximum amount that the minister may levy against a person under section 71(2) of FRPA for contravention of section 52 (1) or (3) is the *greatest of the following amounts*:
  - An amount equal to the product of
    - The volume (in m^3) of the Crown timber subject to contravention, and
    - \$200 per m^3
  - An amount equal to the product of
    - The area, expressed in hectares, that contained the timber subject to the contravention, and
    - \$100,000 per Ha
  - An amount equal to the sum of
    - The stumpage and bonus bid that in the opinion of the minister would have been payable if the volume of timber subject to the contravention had been sold under a BC timber sales agreement at the time of contravention
    - Twice the market value of logs and special forest products that in the opinion of the minister were, or could have been, produced from the timber that was subject to the contravention
    - The costs that have been or will be incurred by the government in re-establishing a free growing stand on the area, and

- The costs that were incurred by the government for silviculture treatments to the area that were rendered ineffective because of the contravention

The Wildfire Act puts the onus on the person managing and those people involved in the burning treatment. This requires that these individuals determine if burning is a safe decision on that day and time and that reasonable precautions are taken to ensure that the fire is contained at all times. The Wildfire Act applies on both Crown and private land in BC.

Here are some guidelines taken from "Industrial and Resource Management Burning Brochure" (2014):

- Check with FLNRO for bans or restrictions on open burning. These are put into place when the forest is dry and the danger of fire increases. Check the Ministry website: www.BCwildfire.ca or phone Fire Information line at 1-888-336-7378.
- Check the forecast and wind conditions. If the wind is strong enough to carry sparks to other combustible material, do not burn.
- When conducting a Resource Management Burn one must ensure that all obligations specified in the Burn Plan are met, including resources required on ignition and in the event of an escape.

Under the law, you must watch the fire to prevent escape. If an escape occurs, the person responsible for the fire must be equipped with at least one fire fighting hand tool to control and extinguish the fire. If the fire gets out of control, try to extinguish the fire and report the escaped for to FLNRO or 911 or fire emergency in BC (1-800-663-5555 OR *5555 on a cell phone). Continue fighting the fire in a safe manner until relieved by an official.

Finally, you must extinguish the fire before the leaving the area. Ensure that ashes are cold to the touch. A Category 3 open fire must be extinguished in adherence to the requirements of the burn registration number.

Careless or improperly conducted open burning costs BC in excess of 3 million dollars annually.

Contravention of the Wildfire Act is an offence. A person who contravenes the Wildfire Act may be liable for an administrative penalty, a fine upon conviction, and/or firefighting and rehabilitation costs as specified in the Wildfire Act. The Wildfire Act applies on both private and Crown land throughout BC.

Offences/Penalties (Wildfire Act, S. 43):

- Intentionally/recklessly causing damage to crown forest land or grass land in contravention of Section 6(1) – liable on conviction to fine up to $1 million and/or imprisonment up to 3 years
- Starting fire within 1km of forest land or grassland without prescription - liable on conviction to fine up to $500,000 and/or up to 2 years imprisonment

- Failure to abate fire hazard in prescribed period of time to prescribed extent – liable on conviction for fine up to $100,000 and/or up to 1 year imprisonment
- Failure to report fire/take appropriate actions to extinguish fire – liable on conviction for fine up to $5,000 and/or imprisonment up to 6 months

Administrative Penalties and cost recovery (Wildfire Act S.27):

If Minister determines contravention has occurred, the minister may:

- Levy an administrative penalty against the person in an amount not exceeding the prescribed amount,
- Determine the amount of the government's cost of fire control under section 9 for a fire that resulted, directly or indirectly, from the contravention
- May determine the amount that is equal to the dollar value of any
    - Crown timber,
    - Other forest land resources,
    - Grass land resources, and
    - Other property.

  Of the government damaged or destroyed as a result, indirectly or directly, of the contravention.

- May determine the costs
    - That have been or will be incurred by the government in re-establishing a free growing stand as a direct or indirect result of the contravention, and
    - That have been incurred by the government for silviculture treatments that were rendered ineffective as a direct or indirect result of the contravention
- May require the person to pay the amounts determined and the costs determined (see above), subject to prescribed limits, if any

Remediation Orders (Wildfire Act, S. 28)

If the Minister determines that a person has contravened a provision of this Act or the regulations, the Minister may order the person to do work, at the person's own expense that is reasonably necessary to remedy the contravention and to repair any damage caused by the contravention

Liability of employers, directors and officers (Wildfire Act, S.30)

- If a person's contractor, employee or agent contravenes a provision of this Act or the regulations in the course of carrying out the contract, employment or agency, the person also contravenes the provision

- If a corporation contravenes a provision of this Act or the regulations, a director or officer of the corporation who authorized, permitted or acquiesced in the contravention also contravenes the provision.

7.3 Additional sprinkler kit specifications:

Table 2. Estimate of sprinkler unit costs (Swart, 2016)

No.	COMPONENT	PRICE Est. ($)	Quantity for 1 Property	Cost per Property ($)	Cost per Trailer (3 Properties) ($)
1	sprinkler	175	10	1750	5250
2	hose 3/4" x 50'	60	5	300	900
3	hose 3/4" x 30'	40	5	200	600
4	water thief	35	10	350	1050
5	gated wye 3/4"	15	4	60	180
6	couplings 3/4"	15	4	60	180
7	conduit clamps 3/8"	5	16	80	240
8	3000 gal. water bladder	3500	1	3500	10500
9	pump	4900	2	9800	29400
10	relay hose 1 1/2" x 100'	165	42	6930	20790
11	3-way wye	75	1	75	225
12	trailer	2150	-	-	2150
	TOTAL		**-**	**$23,105**	**$71,465**

Table 3. Sprinkler component specifications (Swart, 2016)

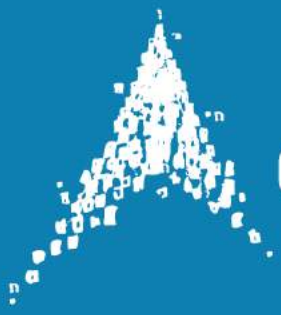
No.	COMPONENT SPECIFICATIONS
1	1.0" sprinkler brass impact, w/ dual steel step spike, ¾”GHT*
2	3/4" x 50' synthetic hose (300psi) w/ GHT couplings
3	3/4" x 30' synthetic hose (300psi) w/ GHT couplings
4	1-1/2" NPSH* water thief, QC* w/ ¾” GHT shut off
5	3/4" gated wye GHT couplings
6	3/4" double female GHT couplings
7	3/8” conduit clamps
8	3000 gallon US bladder w/ couplings to connect pump to bottom
9	Mark 3 fire pumps
10	1-1/2” x 100’ forestry hose weeping QC
11	1-1/2" NPSH three way gated wye, QC
12	Enclosed utility trailer for component storage and transport = average price of 10 used trailers

*Thread definition: NPSH (National Pipe Straight Hose), GHT (Garden hose Thread), QC (forestry quarter turn /quick coupling)

Table 4. Examples of standby generator unit prices, comparing Kohler, Briggs & Stratton, and Cummins brands.

Standby Generator	Cost (CAD $)		
Output (kW)	Kohler	Briggs & Stratton	Cummins
10 - 12	4014	3270	-
13 - 20	4161	4999	4841
21 - 25	13533	11026	12048

*These are base prices, not including taxes, installation, and transfer switches (to transfer power from the generator instead of the utility source, ~$500)



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