March 16th, 2020

# Fuel Treatment Efficacy Project Summary

## Background

Fuel treatments are an essential prevention tool when it comes to wildfire risk reduction around communities and critical infrastructure. Forest fuel treatments are applied at various scales across B.C., both within and outside the wildland urban interface. Treatments can be done in a variety of ways including reducing ladder and surface fuels, overstorey thinning, or changing stand and species composition. A fuel treatment could include larger landscape fuel breaks, targeted mechanical fuel treatments in the interface, larger natural/prescribed fires on the land base, and some silvicultural activities done post-harvest.

Understanding the objectives, approaches to designing and implementing fuel treatments and the linkages to final outcomes is fundamental to a successful wildfire risk reduction program. Currently there is no documented process for BCWS around the gathering of the historical pre and post treatment data and where relevant fire behaviour and suppression tactics have been influenced by the treatment.

In the past five years there have been encounters with wildfires and fuel treatments in different ecosystems and fire weather conditions across B.C. This provides an opportunity for a targeted approach to gathering both fuel treatment and fire behaviour data to increase the knowledge and understanding of interactions between wildfires and modified stands. This project will evaluate the effectiveness of fuel treatments on impacts to fire behaviour, as well as review the efficacy of fuel breaks both in terms of location suitability and impacts to the overall rate of fire spread.

## Objective

To evaluate the effectiveness of fuel treatments when they have been challenged by wildfire event. To evaluate data gaps (e.g fire behaviour progression) and provide recommendations for program tools, products and guidance to implement a comprehensive fuel treatment monitoring program in B.C.

To describe and categorize fuel treatments that have been used in recent years, determine how they have been affecting wildfire behaviour and wildfire suppression tactics, and, based on these findings, provide recommendations that will help practitioners improve the effectiveness of their fuel treatment programs and improve field data collection (pre and post fire impacts) to enable furthers studies.

## Current Status

The Project is occurring in 4 phases:

Data Acquisition, Literature Review, and Analysis Framework (current phase)

1. Field Assessments
2. Analysis
3. Reporting
4. Literature review and summary

During this project, an analysis of where fuel treatments had recently interacted with a wildfire was completed and 16 field sites were selected from that list focusing on 5 fire centres for the first year of the project. The 5 centres that were chosen for the study include: Cariboo, Southeast, Kamloops, Prince George, and Northwest. Each site was then visited for data collection and to support case study development and the summarization of how the wildfire interacted with that specific fuel treatment. This information is being used to create a better understanding of fuel treatments, and the positive and negative affects they've had on fire behaviour and intensity. This will help influence the development of future, and effective fuel treatments.

Currently the project has completed a literature review and summary, interviews of key BCWS staff and local practitioners, site assessments including field photos and some drone imagery and preliminary data evaluations. The 2019 field season has been completed, and information pertaining to the sites selected has been collected and organized (including weather indices, fire behaviour information, photos, personnel on site, prescription of fuel treatments, tactics, and any other relevant information). There has also been an initial case study that is currently under development of a specific site in the Cariboo through careful fire behaviour analysis, as well as interviewing key personnel that were on site during the fire.

## Key Learnings to Date

During the process of this project, some key learnings have arisen:

- Preliminary observations from the field sites indicate that:
    - historical treatments are often not located in logical locations with anchors to non fuel or working form the value out,
    - treatment area is often too small to have had a measurable effect on fire behaviour,
    - thinning mature or near mature stands coupled with surface fuel removal appears to be cost effective and feasible at a scale that can make a difference,
    - silviculture treatments, including both site preparation (broadcast burning and disc trenching) show demonstrated influences on fire spread and behaviour in the landscape
- There is evidence in B.C. that fuel treatments are affecting fire behaviour in positive ways, however, there is a paucity of examples in which wildfire has interacted with fuel treatments, not just in B.C., but across North America.
- Building on the FP Innovations work on data collection methods in their Rapid Response Kit, it would be valuable to build a formalized process to collect weather, fuel loading information, and fire behaviour data on selected fires in real time to test data collection tools and further our understanding of fuel treatment efficacy.
- It was evident in many of the recent fires that more research is required to understand the impacts of silviculture treatments on fire behaviour: stands aged 20-40 years can be quite resistant to wildfire, even in the most extreme circumstances, but more research is required is understand the exact reasoning for this (less understory fuel, closed canopy, high crown-base height, morphology of these age classes, etc.)
- There is a need to develop a framework for fuel management decision making that is based on objective, measurable site parameters and that considers broader scale, modelling tools, and socio-economic factors.

## Next Steps

There are also multiple different areas that will have continued work this coming year, including:

- The Kamloops Fire Centre has been approached to support a possible pilot. The goal is when there are fires occurring near and within fuel treatment areas, that personnel can be collecting data on fire behaviour and intensity to better understand fuel treatments and their effects on fire. There is currently an ARC GIS program that has all operational treatments (including FESBC, and pre/post 2013 operational treatment) spatially that can be accessed during a fire.
- Undertake more field evaluations of unexamined sites in the interior and on the coast (identified from discussions with practitioners). *Rationale*: there were a couple of sites that were not visited that could potentially provide useful information on fuel treatment efficacy. Additionally, there may be treatment sites that were burned in wildfires in 2019 that might provide insights.
- Evaluate the data gaps and provide recommendations for improving incident level field data collection around fuel treatments and their influences on fire behaviour and suppression tactics.
- Prepare a final report including mapping products. *Rationale*: the report would target those who have a deeper interest in the basis for the decision making tool (policy makers, researchers, authorization agencies) and are interested in, for example, the scope of the project, methods, and results (case study results and learnings, how fuel management practices are affecting fire behaviour and suppression tactics/efficacy); data summaries and the treatment efficacy matrix, recommendations on principles and best management practices for fuel reduction; and a list of recommended literature.
- Identify a methodology/framework for prioritizing and undertaking fuel treatment efficacy trials. *Rationale*: Advancing our knowledge of fuel treatment efficacy is urgent and out of sync with the vagaries of wildfire randomly interacting with fuel treatments. It is expected that the current project will shed light on key knowledge gaps and what types of data would be most useful in determining fuel treatment efficacy.
- It was evident in many of the recent fires that more research is required to understand the impacts of silviculture treatments on fire behaviour.

## Project Summary

Updated at Jan 19th, 2020

### Work Completed

Work plan development
Literature review and summary
Interviews of key Wildfire Services staff and local practitioners
Fire data review, analysis, and selection of potential study sites
Mapping
Development of a field protocol and field cards
Development of a sample plan
Site assessments with and without Wildfire Services staff including field photos and some UAV imagery (see table below).
Preliminary data evaluations.

### Field Sites Visited

| FireZone | Site Name | Fire No. | Priority[1] | Comments |
|---|---|---|---|---|
| Caribou | | | | |
| | Airport | 2017-C20729 | H | Includes treatments that interacted with fire and treatments that never interacted with fire. The later have been visited by other team members but these are not as informative as the ones that did interact. |
| | Fox Mtn | 2017-C20729 | L | 100% logged. |
| | Hanceville | 2017-C50647 | M | Long linear treatment in a curious location, SWPI. |
| | LeesCornerA | 2017-C50647 | M | Thinning treatment around the mill site. |
| | LeesCornerB | 2017-C50647 | L | Fire resistant second growth. |
| | Nazko | 2019-C10205 | H | Wildfire adjacent to village. Partial fuel treatment. Data already provided by Andrew |
| Kamloops | | | | |
| | Lytton IR21 | 2014-K70270 | H | Brad has information for this site as does Bruce Morrow and Andrew provided some info. A thinning treatment with some pruning. |
| | Lytton IR22 | 2014-K70270 | H | As above. |
| | Flat Top Mtn | 2017-K51406 | H | Two broadcast burn areas that interacted with wildfire. |
| | Garnet Valley | 2017-K52024 | M | No specific location was ever identified by Mike but the fuel treatment here looked good (thinned, bucked, and piles burned). |
| | Hat Creek | | M | Incomplete execution of thinning/pruning treatment here. |
| Prince George | | | | |
| | Nadina Fire | 2018-R21721 | M | Fire resistant second growth at many sites. |
| | Peta Fire | 2013-G40284, 2014-G40112, R11498 | M | Interaction of multiple fires, some thinning treatment. |
| | Shovel Fire | 2018-R11498 | M-H | Landscape level fuel reduction (logging and fire resistant second growth) and one small SWPI treatment (thinning and pruning) next to Ormond Lake. |
| SouthEast | | | | |
| | Al Neal Site | 2017-N21451 | H | Island pond fire, thinning treatment. |
| | Elk River Site | 2015-N10269 | M | Range/ER burn. |

1. Priority refers to the potential for including the data in case study analyses.

**Learnings To Date**

- There is evidence in B.C. that fuel treatments are affecting fuel behaviour in positive ways, however, there is a paucity of examples in which wildfire has interacted with fuel treatments, not just in B.C., but across North America.
- Given the random nature of wildfire interactions with fuel treatments, the often weak documentation of both treatments and fire behaviour, and the complexity of the relationship between fuel, weather, and treatments, there appears to be an opportunity for undertaking formalized burning trials in fuel treated areas to accelerate our understanding of fuel treatment efficacy.
- It was evident in many of the recent fires that more research is required to understand the impacts of silviculture treatments on fire behaviour: (what are the mechanisms for 20-40 year old stands being resistant, how long does the impact of broadcast burning last, do treatments that realign slash make a difference, is it ok to leave CWD if it is not in piles (where piles can contribute to spotting), how many tonnes/ha of fine fuels can we tolerate and how long does it persist, etc)
- Expert knowledge is important and useful but sometimes its anecdotal nature makes it difficult to use in creating guidelines, policy, and a formal framework for practitioners.
- Building on the FP Innovations work on data collection methods in their Rapid Response Kit, it would be valuable to hire staff or contractors for some or all fire centres to collect weather, fuel, treatment, and fire behaviour data on selected fires in real time to test data collection tools and further our understanding of fuel treatment efficacy. A dedicated fire behaviour specialist at each fire centre could fill this role, as well as support suppression efforts, and perhaps play an outreach role in terms of technology transfer to Wildfire Services personnel, licensees, Regional Districts, and possibly the public.
- Landscape level planning seems to be under implemented.
- Dedicated funding for fuel treatments in the WUI seems to be necessary to ensure fuel treatments are completed and maintenance is ongoing.
- Preliminary observations from the field sites indicate that: treatments are often not located in logical locations (i.e. they ignore landscape level planning), treatment area is often too small to have much effect, thinning mature or near mature stands appears to be cost effective and feasible at a scale that can make a difference, silviculture treatments, including both site preparation and management of stand structure through planting and density control, have significant impact on fire resistance, but, under certain weather and fuel conditions, there are no treatments that are going to be effective.
- There is a need to develop a framework for fuel management decision making that is based on objective, measurable site parameters and that considers broader landscape level planning, modelling tools, and socio-economic factors.

**Continued Work And Rationale To Build on Learnings**

- Acquire weather data, fire data, and treatment details for selected sites that had field assessments. *Rationale*: this data is needed for the case studies.
- Undertake more field evaluations of unexamined sites in the interior (identified from discussions with practitioners). *Rationale*: there were a couple of sites that were not visited that could potentially provide useful information on fuel treatment efficacy. Additionally, there may be treatment sites that were burned in wildfires in 2019 that might provide insights.

- Undertake field evaluations of coastal sites. *Rationale*: Wildfire Services should provide a framework for fuel treatment decision making for all parts of the province.
- Summarize treatment outcomes from field investigations (in case study format – refer to Brad's initial example and my comments). *Rationale*: There is insufficient field data to develop a decision making matrix for all parts of the province and all potential variables (different sites, different fire weather, different treatments). An alternative approach is to develop case studies for as many areas as possible to highlight key considerations that will be applicable in other locations where there are similar circumstances. The case study approach is easily digested and a traditional and familiar approach to analysing fire management. Summarizing the case studies will provide the basis for making fuel treatment recommendations.
- Evaluate the utility of fire behaviour models. *Rationale*: The utility of fire behaviour models and other provincial fire behaviour tools in helping practitioners make decisions about fuel treatments could be tested for the case study areas to decide if they should be included in a decision matrix.
- Develop a fuel treatment decision matrix based on observed results in the case study areas, the literature, and the experience of expert practitioners. *Rationale*: A decision making tool for fuel treatments is the primary outcome for the project and could provide practitioners with an easy-to-use reference for designing, approving, or evaluating fuel treatments.
- Prepare a final report including mapping products. *Rationale*: the report would target those who have a deeper interest in the basis for the decision making tool (policy makers, researchers, authorization agencies) and are interested in, for example, the scope of the project, methods, and results (case study results and learnings, how fuel management practices are affecting fire behaviour and suppression tactics/efficacy); data summaries and the treatment efficacy matrix, recommendations on principles and best management practices for fuel reduction; and a list of recommended literature (in an appendix).
- Identify a methodology/framework for prioritizing and undertaking fuel treatment efficacy trials. *Rationale*: Advancing our knowledge of fuel treatment efficacy is urgent and out of sync with the vagaries of wildfire randomly interacting with fuel treatments. It is expected that the current project will shed light on key knowledge gaps and what types of data would be most useful in determining fuel treatment efficacy. Purposefully emulating wildfire for a variety of fuel treatments in an area with diverse site conditions will help provide answers in a timely fashion as well as help validate fire behaviour models.
- Development of a fuel treatment guidelines brochure for implementation planners and practitioners. *Rationale*: this type of document is meant to be easily read, practical, and will likely be the easiest way to effect change in fuel management practices. Such a document would include, for example, photos and diagrams, information on fuel management principles, data requirements, and best management practices, and would complement the FP Innovations Rapid Response Kit.

**Costs to Date**

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|---|---|
| Original contract value: | $50,000 |
| 2019 expenditures: | $42,401 |

**Estimated Costs to Complete the Project**

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|---|---|
| Acquire fire data, weather data, and treatment data for completed field sites | $4000 |
| Field data collection (coastal and interior) | $12000 |
| Fire behaviour modelling | $2000 |

| | |
|---|---|
| Write-up case studies and lessons learned | $10000 |
| Data analysis and development of a fuel treatment matrix | $6000 |
| Report | $8000 |
| Brochure | $5000 |
| Research Framework | $3000 |
| Total | $50000 |