Wildland/Urban Interface Fires, Fuel Management, and Ecosystems

November 5–6, 2008
Cranbrook, British Columbia
Canada

Columbia Mountains Institute of Applied Ecology

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- BC Ministry of Agriculture and Lands
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- Parks Canada

Thanks also to our speakers and the people who brought posters and displays. We are grateful for your willingness to share your expertise with us.

Special thanks go to our volunteers Ernst Bevan (Thompson Rivers University) and Melissa Hogg (Simon Fraser University) for their help in keeping the event running smoothly.

Our presenters and participants travelled from various communities in British Columbia, Alberta, and Montana. We are grateful for their participation and for the support of their agencies in sending them to our conference.

We are grateful for the work of our conference organizing committee. The members of the organizing committee were:

- Patrick Daigle, BC Ministry of Environment and CMI Director
- Gregg Walker, Mount Revelstoke and Glacier National Parks
- Gregg Anderson, BC Ministry of Forests and Range
- Nikki Rivette, BC Ministry of Forests and Range
- Jackie Morris, CMI Executive Director

Conference Description

Management plans for reducing the likelihood or severity of wildland/urban interface (WUI) fires are in preparation and, by their nature, favour economic and social factors. Through one and half days of presentations, a poster session, and field trips, we examined these factors and addressed how management for WUI fires and fuels might also accommodate, or improve, ecological values. Presentations were selected from a "call for papers," and favoured activities in provincial and federal parks, where WUI fire plans put a high priority on ecological values.

About 145 people attended the conference. Participants were multidisciplinary and included staff from federal, provincial, regional district, and municipal governments; resource managers from the private sector; public interest groups; and academia. A class from Selkirk College in Castlegar attended the first day of the conference.

The summaries of presentations in this document were provided by the speakers. Apart from small edits to create consistency in layout and style, the text appears as submitted by the speakers.

The information presented in this document has not been peer reviewed.

About the Columbia Mountains Institute of Applied Ecology
www.cmiae.org

The Columbia Mountains Institute of Applied Ecology (CMI) is a non-profit society based in Revelstoke, British Columbia. The CMI is known for hosting balanced, science-driven events that bring together managers, researchers, educators, and natural resource practitioners from across southeastern British Columbia. CMI members include resource managers, consultants, government staff, public interest groups, and academics, who share an interest in improving the management of ecosystems in southeastern British Columbia. Our website offers many resources, including conference summaries for all of our past events.

Conference Agenda

Wednesday, November 5

8:30 a.m.	**Welcome** by Master of Ceremonies, Patrick Daigle **Welcoming remarks** by Councillor Scott Manjak, City of Kimberley and Joe Pierre, St. Mary's Band
8:45 a.m.	**Coming to terms: Common understandings of terminology,** Patrick Daigle, BC Ministry of Environment
9:00 a.m.	**Fire management in BC parks,** Lyle Gawalko, Protected Area Division, BC Ministry of Environment
9:30 a.m.	**From collaboration to implementation: The status of interface fire management in Williams Lake and area,** Mike Simpson, Fraser Basin Council
10:00 a.m.	**First Nations community safety from wildfire in areas affected by mountain pine beetle: The work of the Forest Fuel Management Working Group**, Al Gerow, First Nations Forestry Council, and Blaine Wiggins, First Nations' Emergency Services
10:30 a.m.	*Coffee break*
10:50 a.m.	**Lessons learned: Interface fuel management and ecological restoration in parks of the Okanagan,** Judy Millar, BC Ministry of Environment
11:20 a.m.	**Ecological effects of wildland/urban interface forest management in Banff National Park,** Ian Pengelly, Banff National Park
11:50 a.m.	Brief words by people bringing posters, brief words by field trip leaders
Noon	*Lunch, provided*
1:00 p.m.	**Fuel management and the rare damselfly, *Argia vivida*,** Andrea Kortello, Banff National Park
1:30 p.m.	**Effectiveness monitoring of fuel abatement treatments in southwest Yukon,** Brad Hawkes, Pacific Forestry Centre, Canadian Forest Service
2:00 p.m.	**Prescribed burning in Mount Robson Provincial Park: Balancing terrain stability with biodiversity, habitat, forest health, and fuel management,** Kirk Safford, BC Ministry of Environment
2:30 p.m.	*Coffee break*
2:45 p.m.	**Mythbusters: Communication programs within a community wildfire protection program,** Raymond Schmidt, Banff National Park
3:15 p.m.	**Using stakeholder input to measure fire consequences for wildfire risk assessment,** Matthew Tutsch, Simon Fraser University and Gulf Islands National Park Reserve
3:45 p.m.	**Proposed changes to the Open Burning Smoke Control Regulation,** Rebecca Freedman, BC Ministry of Healthy Living and Sport
4:20 p.m.	Wrap-up, "social," and posters

Evening Presentation

Dr. Cliff White, Banff National Park

**"Wild fires and tame wildlife:
Tales of weirdness from the Rocky Mountain Whooey"**

7:30 p.m. in our conference room
Open to the public

Thursday, November 6

9:00 a.m.	**Funding your community wildfire protection project,** Mark Fercho, Integrated Community Sustainability Planning Leader, City of Prince George; Mike Dittaro, Protection Branch, BC Ministry of Forests and Range; and Sue Clark, Union of BC Municipalities
9:40 a.m.	**Local government involvement in community wildfire mitigation planning and implementation—How does the process work?** Noreen Clayton, Regional District of Central Kootenay *(Noreen was not able to attend, and Simon Grypma, Fire Chief from Nelson BC, kindly stepped in to speak about Nelson's Operational Readiness Plan)*
10:10 a.m.	*Coffee break*
10:30 a.m.	**Fuel management: Effects on wildlife habitat and diversity**, Walt Klenner, Forest Sciences, BC Ministry of Forests and Range
11:00 a.m.	**Ecologically based guidelines for fuel management in the WUI—Optimizing conditions for wildlife**, Alan Westhaver, Jasper National Park
11:30 a.m.	Conference wrap up
12:00 a.m.	Field trips leave

Summaries of Presentations

1. Coming to terms: Common understandings of terminology

Patrick Daigle, Restoration Ecologist, BC Ministry of Environment, Victoria, BC
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> *Inconsistent and imprecise definitions ultimately are manifested in poor stewardship (Cole et al. 2008).*

As workshop organizers had hoped, we had a mixed group of workshop participants enrolled for the event. Participants' professional training and experiences differed widely. Patrick began the event with a quick summary of some basic definitions and concepts important during planning and implementing fuel, fire, and ecosystem management.

WUI

The focus of the workshop is on the areas of land known as the Wildland/Urban Interface (also known as the WUI, or woo-ey). Basically, the WUI consists of areas where flammable wildland fuels are adjacent to homes and communities. The WUI can consist of areas of *interface* and *intermix*. The interface has a clear line between the wildland fuels and human structures (e.g., homes, businesses, reservoirs, and electricity poles). An intermix setting consists of structures scattered across the wildland area, in most instances a little further out of town. Technical definitions for the WUI delve into housing density; for our workshop needs, we won't go to that level of detail. (Stewart *et al.* 2007)

Hazard and risk

Fire hazard, fire risk, and fire risk occurrence are defined in general ways in two sources (Canadian Interagency Forest Fire Centre 2003; US National Wildfire Coordinating Group 2008). The general nature of these definitions limit their usefulness and there are repeated concerns about the definitions (Bachman and Allgöwer 2001; Keller 2005).

However, during this workshop, Mathew Tutsch went into more detail about fire risk (see Mathew's paper in this conference summary, titled: "Using stakeholder input to measure fire consequences for wildfire risk assessment"). Mathew's approach drills down into values at risk, fire probability, and fire consequences; his approach is particularly helpful when dealing with a variety of values and stakeholders.

Restoration and mitigation

Two terms that are commonly used interchangeably are ecosystem restoration and mitigation. This can lead to confusion. Ecosystem restoration is intentional work that assists recovery of an ecosystem that has been damaged, degraded, or destroyed. Basically, it is the practice of restoring ecosystems (Society for Ecological Restoration International, 2004). Goals of ecological restoration may include retaining or restoring ecological structures (such as trees, shrubs, and grasses), and ecosystem processes (such as nutrient cycling).

On the other hand, wildfire risk mitigation actions are designed to make wildfire less severe and to avoid, minimize, or reduce the negative effects of the burn. Thus, the goals of mitigation treatments are usually to protect human life, property, and infrastructure by reducing and/or altering the fuels. (US National Wildfire Coordinating Group 2007)

Through thoughtful planning and implementation, management treatments can be designed to mitigate fuel build-ups, restore ecosystems, or accomplish a combination of both.

Values at risk

Ecological values worthy of consideration during fuel management treatments include: biodiversity, and species and ecosystems at risk. Biodiversity is the variety of native organisms, genes, ecosystems, and the ecosystem processes linking them. Species and ecosystems at risk are those that might be extirpated, endangered, threatened, or of special concern.

Of course, there are social and economic values of concern, including: public and firefighter health and safety, homes, domestic water and animals, businesses, power and transportation infrastructure, fences, recreation, and the numerous costs of fire protection and suppression, and of replacing the listed human values that have been damaged or destroyed. In addition, human emotions and attitudes come into play when the subjects of fire and fuel management treatments come up; these can include anxiety, fear, and issues with public confidence.

Fuelbed strata

There are several fuelbed strata. Ground fuels are within the soil organic horizons (e.g., rotting wood and roots) and commonly these are not seen by an untrained eye. Surface fuels consist of stumps, logs, fallen needles and branches, and low vegetation. Ladder fuels are those arranged vertically and consist of shrubs and small- to medium-sized live and dead trees, and tree branches that lead from the forest floor to the tree crowns. Canopy fuels consist of overstorey live and dead trees. (Sandberg *et al.* 2001)

Forest fire types

Ground fires burn into soils via roots, peat, and rotten wood within the soil. Surface fires burn surface fuels with little burning of the tree crowns. Crown fires burn through the tree tops, usually along with a surface fire. (Sandberg *et al.* 2001)

"Firesafe" principles

In part, to deal with the fuelbed strata and potential forest fire types mentioned above, several basic principles have been posed for forest fuel reduction treatments (Agee 2002; Agee and Skinner 2005). These principles include:

- decreasing surface fuels (to reduce flame length)
- increasing height to live crown (to reduce flame torching into the tree canopy)
- increasing crown spacing (to reduce crown fire potential)
- keeping large fire-resistant trees (to retain ecological structure in the stand)

In addition to this list, others include additional treatments to consider:

- reduce the canopy bulk density (e.g., branches and needles) and canopy continuity to lower the potential occurrence of crown fire (Scott and Reinhardt 2001, and others)

Fuel management or modification

These are planned reductions of living or dead forest fuels, in support of achieving the management objectives of lowering the likelihood of ignition, reducing potential damage, and making fire suppression easier. (US National Wildfire Coordinating Group 2007; Canadian Interagency Forest Fire Centre 2003).

Fuel treatments

Here are a few representative fuel treatments that relate to altering the fuels and then disposing of them.

- To alter the forest fuels, prune or thin trees and cut brush. Then, the fuels may be dispersed on site (e.g., wood shredded or chipped, and branches lopped-and-scattered).
- Alternatively, fuels may be burned on site (in piles or across the whole treatment area).
- In some instances, such as with merchantable logs, logs are taken to a roadside for hauling.

Fuel treatments may be used in combination. Because the site will revegetate, it will be necessary to repeat fuel treatments over time.

Fuelbreaks and fireguards

The terms fuelbreak and fireguard are sometimes confused. A fuelbreak is a barrier or change in fuel type (from highly flammable to less flammable fuels). A fuelbreak may be natural (e.g., a talus slope or a stand of aspen or alder) or man-made (e.g., a wide strip of forestland, from which native vegetation has been cleared). Designing and building fuelbreaks are proactive actions (Canadian Interagency Forest Fire Centre 2003).

In contrast, building a fireguard is a reactive action used during a wildfire; it amounts to strategically creating a barrier that is intended to stop or slow the spread of a wildfire. Fireguards are often created with hand tools or machines (Canadian Interagency Forest Fire Centre 2003).

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2. Fire management in BC Parks

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Lyle is a Forest Ecosystem Officer for BC Parks in the BC Ministry of Environment and he has been implementing an ecosystem management program for BC Parks for the past 5 years. Prior to his current position he worked in BC Parks for 10 years in various roles throughout the province. He has also worked in the forest industry and the BC Ministry of Forests and Range in timber, forest health, protection, silviculture, and seed orchard management. He has a diploma of Forest Technology from BCIT and a BSc in Natural Resource Conservation from the Faculty of Forestry at UBC.

Climate change is profoundly affecting ecosystem processes, structures, and functions. An analysis of climate change impacts on British Columbia ecosystems was completed by Spittlehouse (2008). This report includes climate modelling and summarizes predicted ecosystems and species responses that include:

- Increased forest fire frequency and severity due to warming and drying
- Increased disturbances due to insects and disease
- Potential ranges of species will move northward and upward in elevation
- New assemblages of species will occur in space and time
- Species may be unable to move into areas of suitable climate due to barriers to movement, slow migration rates, unsuitable growing substrate, or lack of habitat

Many of the predicted climate change impacts are already occurring and perhaps the best example is the provincial mountain pine beetle infestation.

Adaptation to climate change will be essential in the coming decades. An excellent summary of adaptation strategies was prepared by Millar *et al.* (2008). Strategies recommended for climate change adaptation include:

- Increase resistance to change
- Promote resilience to change
- Enable ecosystems and resources to respond to change
- Re-align conditions to current and future dynamics
- Reduce greenhouse gases and reduce non-renewable energy use

An example of increasing resistance to change is the establishment of a fuel break in an interface forested landscape, while an example of increasing resilience to change is reducing fuels and ingrowth in fire-maintained ecosystems. Both of these strategies will become increasingly important in British Columbia because the BC Ministry of

Forests and Range Protection Program has completed a provincial threat assessment that identified 1.7 million ha of forest that potentially pose a threat to interface areas, with about 685,000 ha at high risk.

BC Parks has undertaken an aggressive fuel and wildfire management program in provincial parks in the last 5 years. The first priority of the program is to reduce wildfire threats to human values, including park facilities and communities adjacent to parks (Figure 1). The second priority is to minimize the impacts of wildfires on ecological values in parks.

Figure 1. Spruce bark beetle at Cathedral Lake.

While fire is recognized as an essential natural process in parks and other forest ecosystems managed for natural representation, fire must be carefully managed to mitigate its effects on both human and ecological values. The challenge for park managers is to allow fire to take place but ensure that it is both socially and ecologically appropriate.

To reduce wildfire threats, BC Parks has used a range of fire management techniques, including: allowing natural fires to burn; using mechanical fuel removal in smaller urban interface parks; establishing landscape-level fuelbreaks in medium-sized urban interface parks; and using prescribed burning to reduce fuels and establish landscape level fuelbreaks in large wilderness parks. Ecological restoration projects are mainly focused on reducing fuel build up and restoring fire maintained ecosystems where fire has been excluded due to suppression requirements.

The amount of area that can be effectively treated is only a small fraction of the parks system and treatments are focused on establishing high priority fuel breaks or protecting sensitive ecosystems that could be damaged by high intensity fires. In some cases, for example in mountain caribou habitat, fire exclusion may be required to maintain a specific habitat type to assist in wildlife recovery efforts.

Climate change, wildfire, and natural succession will combine to influence forest ecology for decades and BC Parks will use innovative fire management techniques to mitigate risks to both human and ecological impacts when required.

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3. From collaboration to implementation: The status of interface fire management in Williams Lake and area

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Mike Simpson has lived in the Cariboo since 1994, and has been with the Fraser Basin Council since 2006. Providing support to the Williams Lake and Area Interface Fire Plan Secretariat is one of many multi-stakeholder initiatives that he manages. Mike has 18 years experience in natural resource management and facilitation in BC and Ontario, having consulted to a variety of clients in the private sector, all levels of government, First Nations, research organizations, and nonprofit groups. Mike is a professional forester in BC, and has a master's degree in conflict resolution.

The Williams Lake and Area Interface Fire Plan (WLIFP or "the plan") covers the settlement areas in the City of Williams Lake, and the immediate surrounding areas of the Cariboo Regional District that are heavily populated. A 3 km management area surrounds the core area of the plan. This area is in the Williams Lake valley, which is part of the Interior Douglas-fir very dry mild to dry cool (IDFxm to IDFdk3) biogeoclimatic subzone, and is characterized by uneven-aged stands of Interior drybelt Douglas-fir. Fire suppression over the last century has resulted in an unnatural build-up of understorey Douglas-fir saplings and poles, in addition to ladder fuels. Surrounding the valley location are plateau sites, which include stands of lodgepole pine, spruce, Douglas-fir, and aspen.

The WLIFP was created in 2004–2005. Led by the City of Williams Lake, Cariboo Regional District, and University of British Columbia Alex Fraser Research Forest, the process was facilitated by the Fraser Basin Council. The creation of the plan involved all levels of government (municipal, provincial, and federal), forest products companies, woodlot licensees, First Nations, academia, local media (radio and newspapers), other organizations, and individual citizens. The purpose of the plan was to minimize the impacts of fire in the urban-rural interface. Key recommendations were focused on fuel management, communications, fire protection services, and planning initiatives such as development permit areas.

Collaboration has been key throughout the development and implementation of the plan. All interest groups, stakeholders, and First Nations were included from the beginning, and decision making was by consensus. The WLIFP was created before the template of community wildfire protection plans was developed, and the committee reviewed the work of other jurisdictions in British Columbia and Alberta to see what they had done. The committee has since helped other communities to develop their plans.

Planning units within the plan area were based on neighbourhoods, called Interface Fire Planning Units, which led to some degree of leadership within an area.

A multi-party secretariat was formed at the completion of the plan, and has been charged with implementing the plan. The secretariat consists of representatives from the City of Williams Lake, Cariboo Regional District, BC Ministry of Forests and Range (both the Central Cariboo District and Cariboo Fire Centre), Williams Lake Indian Band, and the two major forest licensees in the area (Tolko Industries Ltd. and West Fraser Mills Ltd.).

Challenges and the solutions in the achievement of interface fire management goals are as follows:

Small local governments, limited staff, objection to provincial off-loading

Williams Lake and the Cariboo Regional District are relatively small-sized, low-population areas, with a modest number of staff. There is limited capacity to apply for and manage funds. As such, there was reluctance from the regional district board to the off-loading of interface fire management responsibilities identified in the Filmon report.

Solutions included a July 2007 field tour of pilot project sites and untreated sites, for city councillors and regional district directors, to help raise awareness of the fuel management issues. After the field tour, presentations on funding sources were made to a joint city-regional district committee. Options for “no net cost” led to a blanket approval for a finite number of funding applications.

Private landowners on acreage, difficult to have them attend meetings

Much of the area within the plan is private land, where funding for fuel management projects is not available. It was difficult to entice the public to attend meetings to raise awareness of interface fire risk. Instead, volunteer fire departments in the 150 Mile House and Wildwood areas conducted a door-to-door campaign to deliver FireSmart brochures. They shared their observations with landowners about how their properties could be improved from an interface fire risk perspective. Also, the locations of pilot projects were advertised, so that landowners could view the end result, and emulate the activities undertaken.

Confusing, multiple funding sources for different jurisdictions and tree species

Multiple funding sources exist for different jurisdictions of land (Crown land, Indian Reserve land, and land under municipal control). These sources are constrained depending on whether timber affected by mountain pine beetle is present. In addition to the WLIFP secretariat’s confusion over the funding sources, and recognizing that many small organizations and First Nations bands may be overwhelmed too, we organized a “funding forum” and invited representatives to explain and answer questions on funding sources. Presentations were from Natural Resources Canada, the

Union of BC Municipalities, and the BC Ministry of Forests and Range in May 2008. We invited volunteer fire departments, First Nations bands, local governments, and interface fire committees from throughout the Cariboo–Chilcotin to attend and ask questions.

Lack of awareness of your neighbour's plans and activities

In addition to providing clarity around funding sources, the secondary purpose of the "funding forum" in May 2008 was to meet other people and organizations in the region who are involved in interface fire. Efficiencies in fuel management projects, learning from others, and even leveraging funding sources were the intended outcomes. Most First Nations within the Cariboo–Chilcotin have initiated interface fire plans and some have conducted fuel management projects. Additionally, other municipalities or community associations have implemented fuel management projects. Lack of awareness of subdivision applications for parcels of Crown land also has implications for fuel management projects.

Fuel treatments near Williams Lake: Before and after.

Commercial timber harvest from fuel management activities and timber marks

Some funding agencies, notably Natural Resources Canada, are concerned about how revenue that may be generated from the sale of timber is accounted for when funds are provided for fuel management projects. This is an issue since a limit of $100,000.00 is available to any community per year. The approach taken to date is to separate phases in time: harvest timber first then conduct fuel management. Timber has also been decked. Recent poor markets for timber have resulted in leaving most small volumes of logs for firewood, rather than trying to sell into a poor log market. However, the issue of requiring individual timber marks for each private property is cumbersome, and in the past has limited the ability of landowners with small volumes of timber from being able to sell their logs. Timber marks that can cover multiple properties are needed.

Debris disposal, air quality, venting index, valley location

For fuel management projects, factors restricting the options for burning debris piles include valley location, a limited number of good burning days, air quality concerns, and proximity to residences. Current and future projects will seek funding to chip material, and either leave chips on site or haul chips to the local cogeneration plant. The cogeneration plant does not pay for material or hauling as it has traditionally utilized fibre from local sawmills since beehive burners were banned in the 1990s.

Maintaining profile of interface fire

The WLIFP secretariat wishes to convey the message that interface fire is a "when" not an "if" situation. As memories of the summer of 2003 fade from people's minds, it is increasingly difficult to encourage private landowners to take action to FireSmart their properties. Our communications efforts have been focused in early summer, when the weather turns hot, and when there is news of fires in the region or smoke in the air.

Future opportunities for achieving the recommendations of our plan, and interface fuel management in general, are:

- *Bioenergy.* Development of bioenergy operations may lead to a commercial market for material generated from fuel management projects, rather than depending on funding sources to chip and haul material.
- *Air quality initiatives.* Clean air initiatives from the provincial government have offered funding sources for alternatives to burning.
- *Job Opportunity Program.* The Job Opportunity Program, under the Community Development Trust, has provided a source of labour for fuel management projects.

The *Williams Lake and Area Interface Fire Plan* is available for download at:
http://www.williamslake.ca/files/3/interface_fire_plan.pdf

4. First Nations community safety from wildfire in areas affected by mountain pine beetle: The work of the Forest Fuel Management Working Group

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Al Gerow is a First Nations member of the Burns Lake Band, Carrier Nation Tribe and member of the "Frog" Clan. He is currently the Director of Operations for the BC First Nations Forestry Council and is the Chair of the Forest Fuel Management Working Group. He has many years of experience in the forest industry of the Interior of British Columbia, from harvesting to milling to human resource management. Al has a Diploma in Business Administration from the University of Victoria, a Lead Auditor Certificate from QMI Richmond in ISO 14001 Environmental Management Systems, and is certified as an Employment Councillor. He was elected and served as a Councillor for the Village of Burns Lake and as a Trustee for School District #91.

Blaine Wiggins is from the Bay of Quinte Mohawks in Ontario, but was raised in the Interior of British Columbia. He is currently the Executive Director of the First Nations Emergency Services Society and brings an extensive background in emergency management including positions as a wildfire technician with the BC Forest Service, paramedic, municipal firefighter, and large emergency management response team member for major incidents. He has served as an administrator in the public college and university system and with the Indian and Northern Affairs Canada funding services operations in the BC Region. He holds credentials in business management, computer science, and a Masters Degree in Justice and Public Safety.

Abstract

There are presently 103 First Nations communities in British Columbia that are within the area devastated by the mountain pine beetle (MPB). Given the dramatic increase in forest fuel loading from dying and dead lodgepole pine trees, these communities are on the wildland/urban interface front lines for protection from wildfire. There are a number of First Nations, federal, and provincial agencies currently involved in forest and fire protection management, with various mandates to address forest fuel management and community protection issues. The Forest Fuel Management Working Group (FFMWG) was established in 2006 to bring together these agencies to identify and deliver a co-ordinated program focused directly on First Nations communities in the MPB affected areas of the province. This paper gives an

overview of the purpose and objectives of the FFMWG and a summary of the work it has undertaken with First Nations communities to increase their preparedness for wildfire. This work necessarily addresses First Nations social and economic considerations within the context of First Nations cultural values and traditional ecological knowledge.

Introduction

Many forests in British Columbia have died as a result of the massive mountain pine beetle infestation. As of 2007, just over 710 million m^3 of the total 1.35 billion m^3 of merchantable pine forests have been killed, and this has created unusually high fuel loads in the woods. Further fuel loading will occur over time as it is predicted that 76% of the merchantable pine in the province will be dead by 2015. This, combined with the potential for long periods of dry weather as a result of climatic warming and drying trends, means an increased risk of wildfire will threaten public safety, wildlife, and traditional foods and medicines in and near rural communities.

There are presently 103 First Nations communities situated within the devastated area and, therefore, on the front lines in regard to protection from wildfires. Provincially there are 17 Tribal Councils (15 First Nations communities of the 103 are not affiliated to a Tribal Council) that are impacted by the MPB epidemic.

Overview of the Forest Fuel Management Working Group

There are a number of First Nations, federal, and provincial agencies currently involved in forest and fire protection management with various mandates to address forest fuel management and community protection issues. The British Columbia First Nations/Government Forest Fuel Management Working Group (FFMWG) was established in 2006 to identify and deliver a co-ordinated program focused directly on the MPB-affected areas of the province.

The FFMWG is currently composed of representatives from the following organizations:

- First Nations Emergency Services Society (FNESS)
- First Nations Forestry Council
- First Nations Mountain Pine Beetle Initiative
- Indian and Northern Affairs Canada
- BC Ministry of Forests and Range
- Natural Resources Canada–Canadian Forest Service

Objectives of Forest Fuel Management Working Group

The overarching objective of the First Nations forest fuel management program is to promote First Nations community health, safety, and well-being, while respecting First Nations cultural beliefs, traditions, and practices. The FFMWG assists in achieving this objective by undertaking the following:

- Greater program co-ordination between First Nations, federal, and provincial agencies by:
  * Developing and supporting a co-ordinated team approach to the timely implementation of forest fuel management activities among organizations that have a forest fuel management mandate and/or are accountable for funding forest fuel management activities.
  * Integrating, where appropriate, the forest fuel management program with other current and future related programs such as the First Nations Mountain Pine Beetle Initiative.

- Direct assistance to First Nations communities by:
  * Consulting with MPB-affected First Nations communities in the delivery of their forest fuel management programs.
  * Working with First Nations "pilot" communities to complete their current on-the-ground forest fuel management activities.
  * Developing an appropriate prioritized plan for completing forest fuel management activities with all First Nations communities which are at risk to wildfire, beyond the "pilots."
  * Increasing First Nations capacity in regard to community wildfire protection and forest fuel management.

- Improved and co-ordinated First Nations access to, and use of, funding programs and opportunities by:
  * Working directly with First Nations communities to assist them in their application for forest fuel management and community wildfire protection funding.
  * Assisting in the development of forest fuel management plans (e.g., community wildfire protection plans)

- Enhanced communication and extension by:
  * Developing and delivering an effective and co-ordinated communication and extension program that ensures First Nations communities are aware of, and have access to, the most current best practices, knowledge, and expertise about forest fuel
  * Providing timely updates to the First Nations Forestry Council's Board of Directors, the First Nations Leadership Council, and federal and provincial agencies to ensure that they are kept apprised of the accomplishments, progress, and overall status of the forest fuel management program.

- Continuous improvement by:
  * Identifying areas of forest fuel management strengths and sharing best practices.
  * Identifying weaknesses in forest fuel management programs and activities and seeking solutions to barriers faced by First Nations communities in their

development of forest fuel management plans (e.g., community wildfire protection plans) and their implementation of on-the-ground operations.

* Identifying forest fuel management program threats or opportunities and implementing solutions.

Overall, these actions are intended to achieve greater wildfire protection for all First Nations communities affected by the MPB in the shortest time possible.

SWAT Team

The FFMWG established a temporary task group, entitled the "SWAT Team," with the specific purpose of expediting support to First Nations communities engaged in conducting forest fuel management planning and operational treatments. The SWAT Team consists of operational level forestry and fire management professionals from the FFMWG member agencies and, therefore, can assist First Nations communities by: recommending and providing funding; providing required permits; and offering professional and technical forest fuel management expertise to those First Nations communities that are wishing to deal with the increased threat of wildfire due to the ongoing MPB epidemic. This team has been mandated by the FFMWG to be a "one window shop" that can provide First Nations communities with the information and support that they need to conduct forest fuel management planning and treatments.

As First Nations forest fuel management programs expand and mature it is anticipated that the SWAT Team will become less necessary.

Phase One pilot communities

The forest fuel management program initially began by working closely with seven First Nations communities that had been identified through a comprehensive "risk ranking analysis" exercise and had demonstrated a desire and capacity to move quickly to address their wildfire management issues and threats.

List of the seven Phase One communities:

- Canim Lake
- Cheslatta Carrier Nation
- Nee-Tahi-Buhn
- Skin Tyee
- Stellat'en First Nation
- Ulkatcho
- Wet'suwet'en First Nations

Pilot community visits and assessments determined that there were a number of issues and barriers that currently limit or affect success in First Nations fuel management programs. These break down into key themes: fuel management and programs; communications barriers; human resources and capacity building; fuel management commercial harvesting; and fuel management operational activities.

Key recommendations from the pilot communities phase are:

- There is a need to raise awareness of support and contacts available to First Nations communities.
- Waiting times for community wildfire protection applications need to be reduced.
- Continue to streamline, if and where possible, the federal “Environmental Assessment” process for First Nations communities to begin fuel management activities.
- Provide easy access for First Nations communities to obtain forest cover maps for their reserves to support development of community wildfire protection plans.
- Increase the number of regional fuel management contacts, which would allow for easier access to program applications, lessen time delays, and overcome unforeseen barriers.
- Raise awareness in First Nations communities about other emergency-related preparedness plans and evacuation plans
- A review should be conducted to reduce, remove, or develop stumpage sharing structure fees for First Nations communities that are affected by MPB and are conducting forest fuel management treatments.
- Develop a policy paper about forest fuel management and commercial harvesting that is aimed at co-ordinating these activities.
- Review programs and services for the development of a dedicated First Nations Forest Fuel Management Co-ordinator in each First Nation community.
- Develop and distribute intermittent or quarterly broadcast memos to all 103 First Nations communities providing each community with an update on the fuel management activities conducted to date, best practices, and appropriate contact information for new or emerging fuel management programs.
- Maintain, and revise as required, the BC First Nations Forest Fuel Management Tool Kit and distribute the kit to all 103 First Nations communities.
- Maintain a provincial oversight body, which acts as the umbrella organization for First Nations communities affected by the MPB and which First Nations can contact for information on fuel management programs, provides assistance to communities, and acts as liaison between First Nations communities and government agencies.

Many of these recommendations are either completed or currently being addressed as part of the ongoing FFMWG program.

Phase Two focus communities

While the pilot communities continue to be actively engaged in the forest fuel management program, the FFMWG also recognized the need to broaden their contacts with other First Nations communities. These ”Phase II focus communities” were selected because: they are ready to undertake forest fuel management planning and activities; they are situated within the mountain pine beetle infestation area of the province; and they have a recognized risk for potential wildfire.

List of the 15 Phase Two communities:

- Alexandria
- Alexis Creek
- Kluskus
- Little Shuswap Lake
- McLeod Lake
- Nadleh Whuten
- Nazko
- Saik'uz
- Saulteau
- Soda Creek
- Spallumcheen
- Tl'azt'en
- Tl'etinqox-t'in
- Upper Nicola
- Xeni Gwet'in

Phase Two expectations

It is the intention of the FFMWG to continue to expand the forest fuel management program by reaching out to all MPB-affected First Nations communities as quickly as possible to promote the objective of First Nations community health, safety, and well-being. The expectations for the Phase Two focus communities are that they will be able to benefit from the engagement and learning of the pilot communities to create a more effective and efficient overall forest fuel management program, while at the same time increasing the number of First Nations communities that are safer from wildfire risks. This means that the Phase Two focus communities program can expect to:

- Broaden community engagement
- Complete more Community Wildfire Protection Programs
- Build on the lessons learned from the pilot communities
- Improve the tracking and reporting of community safety from wildfire
- Operationally treat more hectares on the ground

First Nations social and cultural objectives

One of the principle objectives of an appropriate and effective First Nations forest fuel management program is to ensure that it meets First Nations social and cultural objectives. Some key First Nations social and cultural objectives in this regard are:

- Ensuring community safety
- Protecting traditional and spiritual sites
- Enhancing capacity and economic opportunities
- Incorporating and utilizing traditional ecological knowledge

Community safety, as noted above, is the priority objective for the work of the FFMWG. It is particularly relevant to First Nations communities in the MPB-affected part of the province because of the increased risk and hazard from wildfire due to the elevated levels of forest fuels as a result of dead and dying trees. This concern is further compounded because some First Nations communities are isolated and may have restricted access or egress routes for evacuations and for mobilizing emergency equipment.

First Nations traditional use and spiritual sites are foundational to the maintenance of a community's society and culture. Therefore, any effective forest fuel management program must recognize and incorporate this into its planning, particularly in regard to community wildfire protection plans. There are a number of issues that must be considered here including, for example, the issues of appropriate management techniques and confidentiality. This is an on-going piece that must engage each First Nation directly to ensure that its interests are addressed.

There is a great deal of work to be done to fully implement a forest fuel management program and to ensure that communities are safe. On the positive side, much of this work needs to be done at the community level and directly on-the–ground; therefore, the program allows access to funding that can be a direct benefit to First Nations communities and members. This funding can support and diversify current community economic opportunities and enhance the capacity of communities to undertake long-term forest fuel management activities.

An appropriate forest fuel management program must incorporate and use traditional ecological knowledge to achieve First Nations social and cultural objectives. Forest fuel management prescriptions, therefore, can and should be developed within an ecosystem stewardship planning framework that ensures that planning and management decision making is culturally relevant to First Nations, and reflects their unique connection with land and resources and their inherent responsibility to care for the interconnectedness of the land, water, air, people, animals, and fish in a manner consistent with their spiritual beliefs and values. Overall, this will allow First Nations communities, elders, and members to build traditional ecological knowledge directly into forest fuel management, and wildfire plans and prescriptions, in a manner that reflects their knowledge and understanding of ecology while still achieving their community safety objectives. Over time, this may also require further work to better link traditional ecological knowledge to fire behaviour and fuel management treatments.

Meeting practical challenges and supporting best practices

Overall, many First Nations and communities are undertaking a number of effective actions in response to the MPB infestation and the resultant increase in forest fuels and wildfire risk. However, as noted above, there continues to be a number of challenges that reduce or delay the achievement of greater community safety from wildfire. Key challenges are:

- Learning as much as possible from the pilot communities
- Addressing issues of community capacity, including retaining skilled and experienced staff
- Accessing currently available funding programs and budgets more effectively
- Dealing with other pressing community priorities, such as spring flooding, that tend to reduce or delay a focus on forest fuel management treatments
- Improving the effectiveness of fuel management prescriptions and treatments

Best practices

Best practices, by and large, are evident wherever communities have done effective pre-planning to ensure that they are ready for any eventuality before the emergency happens and where there is a commitment to integrated and co-operative programs that reflect First Nations cultural values, interests, and assets. The following best practices information is a summary of submissions that came from First Nations communities themselves. An analysis of best practices shows that these practices can be effectively grouped into the following categories:

- Pre-planning
- Planning
- Fuel management treatments
- Other

Pre-planning

Pre-planning is the work that First Nations communities have undertaken in preparation for subsequent on-the-ground activities or treatments. This work lays the foundation that is necessary to allow or support more effective subsequent actions. Good pre-planning is the hallmark of a well-conceived overall wildfire protection program, since it ensures that communities are better prepared for most, if not all, eventualities.

A fundamental prerequisite to successful and efficient management of MPB issues is effective pre-planning before the implications and demands of an MPB infestation become overwhelming. This ensures that a First Nation is well prepared for any subsequent eventuality. Essentially all of the First Nations who submitted a response had done some level of pre-planning. The best pre-planning practices are:

- Establish First Nation community strategic objectives in regard to wildfire, fuel management, and MPB control as soon as possible. This will likely require the recognition that MPB planning is really “cultural disruption planning,” and therefore needs to be considered within a cultural context. This may include undertaking baseline ethnobotanical studies to better document the relationship between plants, ecosystems, and First Nations culture. It may also help to categorize the strategic objectives in some meaningful way such as: public safety; economic opportunities and land stewardship; economic diversification; cultural enhancement; and environmental sustainability.
- Develop co-operative agreements and arrangements with strategic partners beforehand. This includes, for example, working with local forest companies and BC Timber Sales to integrate forest harvesting with MPB control activities; but also, and perhaps more importantly, establishing co-operative agreements with other local community fire fighting departments and emergency response agencies to ensure that their expertise and equipment is available to support First Nations communities wherever possible.
- Inventory and mapping of important First Nations community, cultural, and environmental assets and values. Then, ensure that any fire fighting strategies and plans incorporate protection of these key values on a priority basis. This may include the development of a prioritized matrix of risks and threats versus likelihood of incidence.
- Plan and develop access routes as soon as possible. This must consider both access in for wildfire fighting personnel and equipment and for evacuation out of isolated communities and reserves that are under imminent threat from a wildfire emergency.
- Manage for the future by considering potential climate change and ecosystem adaptation now. This may include undertaking predictive ecosystem mapping projects to assist in this work.
- Develop and link MPB and wildfire planning, e.g., fire and fuel hazard and abatement strategies, for both on- and off-reserve lands. Do not assume that the MPB or wildfires will recognize or respect reserve boundaries.
- Send willing and capable community members to wildfire fighting training sessions so that they are certified and prepared beforehand.

Planning

Planning is any actual plans that have been undertaken supporting implementation of a program of MPB damage control. This includes plans that assist in the harvest and use of infected trees, and the management of the other forest resources that are, or may be, impacted by the MPB infestation.

Even with the best program of preparedness through effective pre-planning, it will still be necessary to develop specific plans to address key activities or issues. The best planning practices are:

- Develop emergency preparedness plans, e.g., community wildfire protection plans, as soon as possible.
- Link forest management plans and objectives (e.g., timber harvesting cutblocks) with MPB treatment plans and activities. Forest management plans should also consider forest fuels, particularly harvesting waste, to limit and manage this problem at the earliest possible time. This will also potentially allow for the planned efficient use of large harvesting equipment that is already on site to undertake some fuel abatement action.

Fuel management treatments

Fuel management treatments are the actual on-the-ground activities that are being undertaken to deal directly with a MPB infestation, or to address the issues that might arise from the infestation, e.g., forest fuel reduction treatments.

Once completed plans are in hand, it is time to undertake the specific fuel management treatments on-the-ground that will ensure that communities are as well prepared as possible. The best fuel management treatment practices are:

- Use silvicultural systems and treatments that reduce the long-term risk from MPB. This includes, for example, considering reducing the pine component in stands with other, more resistant, species through either selection harvesting and/or planting.
- Undertake, where safe and feasible, proactive fuel management control burns.
- Construct fireguards around homes, communities, and other First Nations valuable assets and sites.
- Use pheromones and trap-trees to concentrate the MPB infestation prior to salvage, and control treatments such as harvesting or pile and burn projects.

Other

Other is a general category to allow the presentation of other best practices that do not easily fit into the previous categories.

There are a number of other actions that can be undertaken to ensure the maximum benefit to First Nations communities. The best “other” practices are:

- Work with agencies such as FNESS, the First Nations Forestry Council, Natural Resources Canada, Indian and Northern Affairs Canada, and the BC Ministry of Forests and Range to ensure that First Nations communities are fully accessing available funding programs and expertise in a timely manner.
- Link forest fuel management treatments with diversifying and sustaining local economies, e.g., establish contractor eligibility lists that preferentially select local First Nations community members and companies so that potential economic benefits are retained locally.

- Consider using MPB-affected wood for other economic opportunities. This can include small-scale options such as community and campsite firewood as well as large-scale options such as bioenergy production.
- Wherever possible, install water hydrants in all new housing developments before any homes are constructed.

Where to next?

Co-ordination and integration will continue to be enhanced through the increased use of a web-based information portal being developed in co-operation with the Union of British Columbia Municipalities. This work will particularly improve the FFMWG ability to track and report on access to the forest fuel management program budget that is currently being managed with the support of the Union of British Columbia Municipalities.

Communications will always be very important. One key approach will be to better use existing mechanisms, such as the FNESS monthly newsletter and linkages to FFMWG member websites, to highlight and extend information to First Nations communities. It is also the intention of the FFMWG to develop and nurture a province-wide network of First Nations communities and members who are directly engaged in forest fuel management work, to assist them in building capacity and extending knowledge.

Finally, not every impacted First Nation or community is applying best practices yet, therefore, there is much more that can and should be done to reach the goal of greater community preparedness and protection from wildfire. This will take a continued concerted effort to identify and update best practices, effectively extend them broadly to all First Nations communities, and ensure that they are implemented. The FFMWG member agencies will continue to support this by making community outreach and contact a priority through activities such as periodic and ongoing community visits.

Ultimately, it is the hope and expectation that all First Nations communities in the MPB-affected areas of the province will continue to increase their level of awareness of, and safety from, potential wildland/urban interface fires. The FFMWG remains committed to this objective and to assisting First Nations communities in this regard.

5. Lessons learned: Interface fuel management and ecological restoration in parks of the Okanagan

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Introduction

The BC Ministry of Environment and BC Parks in the Okanagan Region learned many lessons during the past 6 years of planning and implementing fuel management and ecological restoration projects.

From 2002 to 2006, the staff in the Okanagan completed eight projects: two major projects (Silver Star and E.C. Manning Provincial Parks), two environmentally sensitive projects (White Lake Grasslands and Kalamalka Lake), three campground projects (Gladstone, Fintry, and Ellison) and one wildland urban interface area (Myra Bellevue).

Each project presented challenges and a variety of treatments were used to reach the objectives identified. All of the treatment areas are within a park or protected area. Public health and safety was the main objective. Protecting and restoring ecological values, and reducing the fuel loading and subsequent wildfire risks, were also taken into account.

There were four general lessons learned:

1. Collaboration with stakeholders builds effective partnerships and strengthens the likelihood of success. Partnerships established because of common goals can leverage resources and provide training opportunities.
2. Community engagement will also increase your success by ensuring the community understands your project proposal and is able to provide input into the process. Providing opportunity for the public to participate in the decisions at the beginning of your project will help create ownership and buy-in.
3. Fuel management and ecological restoration in provincial parks and protected areas requires a “light on the land” approach. These types of treatments are generally more expensive when conducted inside parks than outside of parks because of the enhanced environmental standards needed to protect ecological and

cultural values. Soil disturbance, particularly from machinery, can produce favourable conditions for increased risk of invasive plants. Special care is taken to reduce disturbance to natural regeneration, residual trees, and hydrologic function in a treatment unit.

4. In some situations ecological restoration combined with fuel management can further decrease wildfire risk to communities, by creating larger areas where fuels are reduced. The fuel-reduced zone can be placed adjacent to the interface while the ecological restoration zone can be placed beyond that.

Silver Star Provincial Park

Silver Star Provincial Park is known for its extensive cross-country ski and snowmobile facilities, and is popular with hikers and mountain bikers in the summer. Silver Star Resort is one of the most popular destination ski resorts in British Columbia and of high economic value to the community. It is estimated the ski resort and village area is worth approximately $500M. Silver Star Provincial Park is located approximately 20 km northeast of Vernon, BC and the project area is located in the southwest corner of the park. The park surrounds the village of Silver Star and the developed ski area.

In 2003, a Wildfire Hazard Assessment concluded that all trees affected by mountain pine beetle should be removed and all live pine trees should remain. Eighteen treatment units were strategically located to create a fuel management zone that would help to protect the community and ski hill operations. The fuel management zone was constructed approximately 100 meters wide across the BX watershed in front of the cross-country ski area and Silver Star Resort.

The prescription included reducing the canopy closure to 25–30% with removal of all ground and ladder fuels. Essential coarse woody debris was left on site. A permanent road access was created to accommodate future fire management activities.

Fuel treatment operations began in 2004 and were completed in 2007. Some environmental standards that were adopted were:

- Protection of natural regeneration
- Protection of sensitive environmental values by using a variety of equipment including a spider hoe and a helicopter to remove the logs
- Protection of the soil and hydrology by restricting the number of roads and skid trails
- Partial-cutting of targeted dead and dying pine trees while leaving all other species in reserve patches

Lessons learned at Silver Star

- Objectives were different from conventional harvesting in that the operation was a “not for profit” project; more care was needed to protect the ecological values.

- Environmental standards were stricter than in an industrial operation, and therefore, the operations were more costly.
- Hiring an environmental monitor to oversee operations, and training of operators and contractors, was necessary to ensure environmental standards were met.
- The current BC Ministry of Forests and Range processes to remove trees under the Forest Act, particularly with respect to the Appraisal system, do not work well in parks as they do not accommodate the extra care that needs to be taken for environmental protection.
- Operations on snowpack or frozen ground may be necessary to minimize soil disturbance.

E.C. Manning Provincial Park

E.C. Manning Provincial Park is an icon park. It is in close proximity to the Lower Mainland and is easily accessible to the Southern Interior. It has high visitation rates in the summer as well as the winter. There are cross-country ski trails, a ski hill, hiking trails, and four developed campgrounds.

The fuel reduction project consisted of seven main areas:

1. Manning Park Lodge and employee residences
2. The old visitor centre
3. Highway #3 corridor
4. Campgrounds (Mule Deer, Hampton, Coldspring, and Lightning Lakes)
5. BC Hydro utility line along Highway #3
6. Bonnevier fuel break
7. Day use area

The Manning Park Fuel Reduction Project was facilitated by a co-ordinated project team consisting of the Eastgate Fire Protection Society, BC Ministry of Environment, BC Ministry of Forests and Range, Upper Similkameen Indian Band, Gibson Pass Resort, BC Ministry of Transportation, BC Hydro, and several consultants.

The benefits of the team were that all stakeholders and interested parties were engaged from the beginning and were involved with developing the project charter and the communication plan. The engagement process helped each participant understand the objectives and each others' stake in the project. Regular meetings were held to discuss opportunities, progress, and ideas for success. Field tours were held to keep track of progress and to inform interest groups, e.g., naturalists. The team leader (Judy Millar, author) maintained an updated information sheet and sent mailouts to those interested parties that did not wish to attend meetings.

The success of the communication strategy was illustrated by a trusting working group, no negative media publicity, and no opposition from the public. In addition, advocates for the fuel reduction project were created by bringing in members of the community.

Visitor centre

Lodgepole pine (*Pinus contorta*) in the park has been heavily affected by mountain pine beetle. As a result of this infestation, landscape-level tree mortality has occurred resulting in high fuel loading, which created a significant wildfire risk to the park and adjacent values. The project was completed by the Upper Similkameen Indian Band in 2005. The crew was a good example of learning by doing, in that the prescription interpretation from the planners to the ground crew was accepted and implemented.

The first activity was the removal of all the lodgepole pine at the visitor centre. The objectives of this project were to reduce the risk to human life and property by removing dead and dying pine near developments, and to reduce fuel loading to prevent catastrophic wildfires that could adversely affect ecological values. The treatment included removal of all dead and dying pine from the visitor centre to the highway (Figure 1).

Ecological benefits were:

- Removing the dead pine enhanced light penetration to the ground vegetation, which resulted in more forage for wildlife.
- Spending the extra time to retain advanced regeneration will protect environmental values, reduce risk of invasive plants, reduce recovery time of the ecosystem, reduce risk of hydrological impacts, and save several years of recovery time in recruiting new vegetation.
- By removing the pine, climax species such as sub-alpine fir and spruce were able to grow more freely, creating the opportunity for a more biological diverse ecosystem.

In the areas treated around the lodge and in all four campgrounds, over 33,000 deciduous trees of various sizes were planted. The trees will provide shade for the undergrowth, retain moisture for the growing months, and provide organic matter for building nutrients in the soil.

The trees will also provide a screen for the campgrounds and the administration site at the old visitor centre. These plantings were much more costly than conventional planting due to the individual care taken to ensure survival of the seedlings—such as the 4000 protective cones that were installed to create shade and protect trees from wildlife browsing and park visitors.

Figure 1. The forest at the visitor centre during the mountain pine beetle outbreak. Care was taken to retain the advanced regeneration of climax species.

Figure 2. Same area as Figure 1, with dead pine removed. Operations were done on a winter snowpack, thus reducing soil disturbance and discouraging establishment of invasive plants.

Eastgate

In the summer and fall of 2005, a feasibility study was conducted in the Eastgate area of E.C. Manning Provincial Park to determine if the creation of fuel breaks would enable landscape-level prescribed fire to reduce the risk of wildfire to the neighbouring community of Eastgate.

Lessons learned at E.C. Manning Provincial Park

- Bumper trees were useful in reducing impacts to non-targeted vegetation.
- Inviting WCB on site prior to implementation of project will save time and money.
- How a machine operator interpreted a prescription was very important.
- In a park, it was necessary to hire a full time environmental monitor to ensure interpretation from plan to implementation was accurate.
- Strategic planning and detailed site plans are necessary.
- Planning requirements, community engagement, consultation, agreements, and contract management takes time, but done right will save time and money in the end.

Bonnevier fuel break

The goal of the Bonnevier fuel break was to establish prescriptions, in several different stand types, designed to reduce fire behaviour, while restoring ecological integrity and wildlife habitat.

The objectives of the fuel break were to:

- Reduce the wildfire risk to the public, visitors, residents, and travellers
- Minimize future fire suppression costs
- Minimize potential impacts to ecological values including species at risk and wildlife habitats
- Minimize the risks while conducting prescribed fires in the adjacent areas

The fuel treatments varied from full tree removal and hauling of the logs and/or chips to the market to cutting, piling, and burning smaller, non-merchantable trees. In some areas the dead pine provided very few options for treatment due to the size of the trees and the limited access to the area.

While the fuel break is not yet complete, it is apparent that the green-up and open canopies have been a success in areas treated in 2007 and 2008. A similar project occurred in 1996 (12 years ago), wherein the dead pine was removed by helicopter. The forage has increased, the canopy is more open, and the recovery of the ecosystem is well underway.

White Lake Grasslands Protected Area

White Lake Grassland Protected Area is located 20 km southwest of Penticton and is approximately 3700 ha in size. It is within the Ponderosa pine biogeoclimatic zone. Much of it is open forest and the area contains many of British Columbia's red- and blue-listed plants and animals.

The primary role of the White Lake Grasslands Protected Area is to protect these listed species and the habitats they rely on. The park contains the dry grassland and open forest habitats that are dependent upon very hot temperatures. Annual precipitation varies, but has a mean of 284 mm/year, making it the driest zone in Canada, known as a semi-arid desert.

One of the feature species of White Lake Grasslands Protected Area is the White-headed Woodpecker. Originally, the primary purpose of this project was to improve foraging and nesting habitats for the White-headed Woodpecker, which is red-listed provincially and ranked by COSEWIC as endangered. The White-headed Woodpecker is protected under the *Species at Risk Act* and requires mature ponderosa pine stands on benches and hills below 700 m elevation in the Okanagan Valley.

In 2001, the Canadian Wildlife Service's Five Year Restoration Plan identified the White Lake Grasslands Protected Area as a high priority site for White-headed Woodpecker habitat restoration. The goal of the plan is to restore historically important habitat for White-headed woodpeckers to facilitate their recovery in the South Okanagan.

In 2003, the White Lake Grasslands Protected Area was identified in the Parks and Protected Areas Wildfire Risk Assessment as a high priority for wildland/urban interface fuel management, due to its proximity to the community of Willowbrook.

Fuel management prescriptions took into consideration the high ecological values within and adjacent to the protected area. This integrated approach included zoning of priority areas for enhanced fuel reduction and sensitive ecological values.

Thinning was conducted from 2003 to 2007 with a cumulative area of approximately 150 ha. The prescription was to thin the ponderosa pine and Douglas-fir forest canopies to 30–50% and to remove trees that measured less than 20 cm in diameter at breast height. In addition, the reduction of shrubs to less than one meter in height, particularly Saskatoon shrubs, was done to further decrease fuel loading and increase forage for wildlife. The pile and burn portion of the prescription took place in 2006 and 2007.

In 2007, the western pine beetle began to attack the ponderosa pine in the area that had been previously thinned. A green-attack program was initiated immediately with over 100 trees being cut, piled, and burned. This prompted a better look at future target stand conditions while taking into consideration beetle activity. A review of the current prescriptions done in 2008 suggested a three-phase program: green attack activities, followed by a more cautious tree thinning the first year; monitoring for beetle attack; and then another tree thinning the following year.

In March 2008, a 20 ha prescribed fire was conducted by Protection Branch and BC Parks with over 25 staff participating. Looking at the photos from September 2008, it is evident that the grasses and arrow-leaved balsam root have come back and the ladder fuels and ground fuels are greatly reduced.

The burn will be monitored for ecological changes over time. Vegetation monitoring plots and photo plots are located throughout the site (both in treated and untreated areas). The plots were established in September 2007 and re-measured on March 26, 2008, one week after the burn. These plots will continue to be monitored for the next several years to determine impacts of management activities on the ecosystems.

Objectives of the vegetation monitoring program are to assess the impact of restoration activities on natural plant communities and determine whether the restoration activities are affecting invasive plant establishment.

Lessons learned at Whitelake Grassland Protected Area

- Impact assessments ensure that the ecological and cultural values are integrated into fuel management planning in parks and protected areas. The main objective of the project is public safety and this can be realized only after careful mitigation plans are in place with respect to species at risk, sensitive ecosystems, wildlife habitat, archaeological sites, aesthetics, and socio-economic considerations.
- During the thinning, wildlife trees were identified and "no work zones" were flagged. These areas provided patches of thickets that were left, leaving a mosaic rather than perfectly spaced trees throughout

Summary

BC Parks has adopted the Learn by Doing Concept: The Okanagan Region of the BC Ministry of Environment has completed eight projects, treated over 650 ha and spent approximately $2 million to reduce forest fuel and restore valuable habitats.

It is important to engage the public, create partnerships, and integrate ecological restoration objectives into fuel management projects to ensure success.

In order to continue learning, it is imperative to be innovative, take risks, and try new techniques and methods to resolve fuel management issues.

Planning must consider climate change implications and the impacts of the management activities on ecological values.

6. Ecological effects of forest fuel management in Banff National Park

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Ian has worked in Banff National Park since 1980, joining the fire management program in 1989. Over the past two decades he has been involved in many types of fuel management projects including hand felling and burning, mechanical removal and sale of timber, horse and helicopter logging, and prescribed fire in interface areas. Ian has a Bachelor of Science in geography from the University of Calgary.

Fire has shaped the vegetation in the Bow Valley for hundreds and probably thousands of years. However, during the past century increasingly effective fire prevention and fire suppression programs have limited fire activity. The result is an altered fire regime that has shifted from frequent fires burning in grass, shrubs, and open timber, to rare events burning in heavy timber with long range ember spotting.

Our objective—to restore long-term vegetation structure and species composition—will require that the public and park managers feel comfortable living with fire. How can we achieve this while minimizing the amount of angst, number of evacuations, and potential for fire losses? Obviously, removing fuel in strategic locations before fires are ignited or occur randomly is one important component of the program. However, fuel reduction creates areas that are very different from the current landscape. In some cases conflicts arise when wildlife use increases in fuel breaks that are adjacent to areas of high human use. In other cases, the ideal fuels treatment conflicts with other ecological and social objectives, and we must compromise or abandon our fuels treatment project. This presentation describes three case studies where fuels treatment resulted in positive and negative ecological outcomes.

Two Jack Campground

Our first large-scale project was carried out at Two Jack Campground. The 360 sites existed within a dense lodgepole pine forest. Forest thinning around the perimeter and within the campground was carried between 1988 and 1992 (Figure 1). Prior to the project, wildlife was rarely observed in the campground. A decade after the project, fruit production in the thinned forest was vastly more abundant than in the adjacent and nearby unthinned stands. Grizzly bears began to use the campground each fall, foraging on buffaloberry fruits within the thinned forest. Intensive bear monitoring and aversive conditioning failed to solve the problem, so for several years managers closed the campground each August and September until the buffaloberry fruits had fallen off the bushes. Finally managers decided to remove the fruit-bearing female shrubs by cutting them to ground level with brush saws, an expensive but effective solution. This decision was made reluctantly, because of the obvious importance of this artificially enhanced feeding habitat. However, a large area of pine forest was scheduled for thinning near Carrot Creek. This was expected to provide similar high quality buffaloberry feeding habitat in an area with low human use.

Figure 1. Fuel reduction in Two Jack Campground, before and after.

Carrot Creek

Unlike most fuel reduction projects, the Carrot Creek fuel break is a large “strategic” or “landscape” fuel break, over 500 ha in size. This size provided opportunities to put a variety of habitat mitigations in place including extensive unmodified tracts forest, piles of coarse woody debris, and habitat trees. Low intensity surface fire was planned throughout much the area to reduce volatile surface fuels such as common juniper. The fuel break was completed in the spring of 2003 and was important in the management of the Fairholme prescribed burn through the hottest, driest summer in nearly 70 years. In November 2004, a severe windstorm blew over most of the “leave” trees, rendering it ineffective and instead providing an ideal site for intense fire. The area was logged a second time, removing all pine and spruce, leaving only fire resistant Douglas fir and aspen trees on the site. A surface fire in 2008 was implemented to reduce some of the residual logging debris and stimulate the growth of forbs. The final result is more in keeping with the historic landscape than the original thinned (shaded) fuel break.

Sulphur Mountain

The third case study involves a combination of "strategic" and interface fuel breaks on Sulphur Mountain south and west of the town of Banff. The forests in this part of the Bow Valley burned in 1840, 1881, 1885, and 1908. If these historic fires recurred the impact on the town could be severe. The issue is that the lower slopes of Sulphur Mountain are important for the movement of wildlife around the townsite and other natural barriers. The removal of forest cover in this area results in increased noise and light penetration from vehicle traffic, perhaps more odours from the townsite, decreased hiding cover for wildlife, and less snow interception from trees with the result that more effort is required to travel during winter. These effects may deter some species of wildlife or individual animals from using these important corridors. Fuel management began in 1991 and continues to be implemented in a series of three-year projects. This provides opportunities to monitor wildlife and human use and make amendments to the thinning projects to ensure that the corridors remain functional.

In hindsight, it might have been better to have thinned an extensive area outside Two Jack Campground and left the forest within the campground intact. From the Carrot Creek project, we have learned to either do very little canopy spacing or remove most of the trees to minimize the potential for blowdown. However, at the time these projects were designed, support for extensive thinning and clearing did not exist. The 2003 fire season brought increased support for fuels management. However, most projects are still designed to minimize the area treated. Often unthinned buffers are left along waterways, wetlands, and trails, which may compromise the effectiveness of the fuel breaks under some conditions. As fuel breaks may fail, protecting the Town of Banff and communities adjacent to the park also requires a "Plan B". This involves a tactical suppression plans to deploy extensive sprinkler systems, fuel reduction within the urban forests, and gradually replacing wood roofs with less flammable materials.

Currently, we have one project (200 ha) where extensive fuels management is coupled with an ecological objective—the restoration of grassland at the Yaha Tinda Ranch.

However, the degree to which we should adopt or promote extensive fuels management to achieve both ecological and fire protection objectives has not been resolved in National Parks.

7. Fuel management and the rare damselfly, Argia vivida

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In 10 years of wildlife research for Banff National Park, Andrea Kortello has worked with a variety of taxa including birds, bears, whitebark pine, wolves, amphibians, and insects. Current projects include impact assessments and ecological monitoring for fuel management and prescribed burn projects in Banff. Andrea received her Masters of Science from University of Idaho in 2005 for her study on competitive interactions between wolves and cougars.

Dispersal has important consequences for population persistence via gene flow and "rescue" effects, particularly for rare or fragmented populations. In Banff National Park, the damselfly *Argia vivida* is at the northern limit of its range and is restricted to several small populations inhabiting thermal springs near the town of Banff. Nearby populations in British Columbia are considered imperilled. We investigated habitat selection and dispersal of *Argia vivida* in an upland corridor of thinned and intact forest to assess habitat connectivity and use with respect to fuel management actions in the wildland/urban interface.

Figure 1. *Argia vivida.* Andrea Kortello photo.

Damselflies use aquatic habitats for reproduction and larval development. Adults use adjacent riparian and terrestrial habitats for foraging and dispersal. *Argia vivida* are the only species of damselfly adapted to breed in geothermal springs and adults possess high thermal requirements for flight. Consequently, during the day, *Argia vivida* are most commonly found perching in warm sunlit patches in the forest. Furthermore, their abundance at springs appears to be related to the availability of trees for night roosting sites.

Two thermal spring populations on the periphery of the town of Banff comprise the majority of observations of *Argia vivida*; these are the Cave and Basin springs, and Middle Springs. Middle Springs is relatively unmodified, while suitable breeding habitat at Cave and Basin is bisected by a 1.5 ha clearing and building complex.

Although separated by approximately 1 km of forest, infrequent dispersal events have been documented between Cave and Basin and Middle Springs. In contrast, *Argia vivida* are rarely found at another suitable thermal spring 3 km distant that lacks trees and is separated from the other springs by open marshland and intermittent forest.

Based on *Argia vivida* habitat associations with forested landscapes, planned fuel treatments within the dispersal corridor between Cave and Basin and Middle Spring raised concerns about the impacts to movement patterns and population connectivity between the springs. To address uncertainty with respect to the effects of fuel treatments on *Argia vivida*, we used an adaptive management approach. Operations were planned incrementally, in order of priority, in three stages over 9 years. Each stage was followed by research and monitoring, with the capacity to inform and modify subsequent plans. The first stage, in 2005, involved clearing trees in a series of rectangular patches 100 m x 50 m (total area 5.5 ha), across the predicted direction of spread of fire.

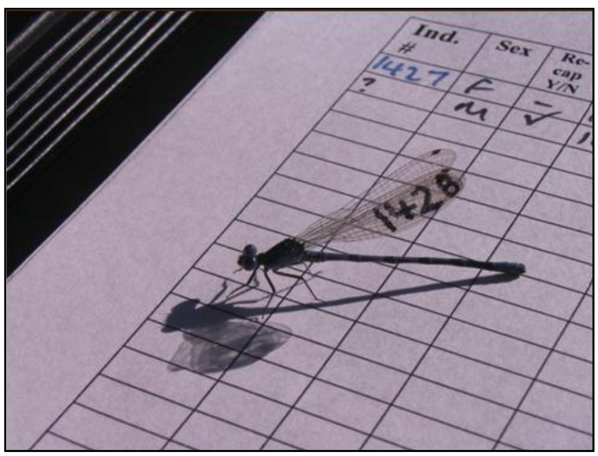

Figure 2. Damselflies are marked on the wings with felt pen. Simon Ham photo.

Afterward, using mark-recapture techniques (Figure 2), we determined flight distances for *Argia vivida* and confirmed continued inter-spring dispersal movements. Within the dispersal corridor we found that flight distances for animals caught in cleared areas were similar to animals caught in unmodified forest. Additionally, there was no difference in flight distance between animals caught at either thermal spring, despite Cave and Basin having more cleared areas in the immediate vicinity.

In the next phase, during 2008, other blocks (total 9.5 ha) of the forested corridor were thinned uniformly to reduce canopy density. After this stage, we monitored habitat use in cleared, thinned, and unmodified forest using point counts. We used logistic regression to model *Argia vivida* presence/absence and based our model selection on Akaike Information Criteria (AIC). We found *Argia vivida* chose fuel treatment blocks that were cleared in patches over areas that were either thinned uniformly or left intact, and preferred sites characterized by the heterogeneous canopy closure of habitat edge. We suspect that *Argia vivida* favour the microclimate provided by persistent sunspots found in large forest openings due to their high minimum temperature requirements for flight, while protection from wind and night roosting requirements necessitate closed forest cover nearby.

Although thinning has the potential to affect damselfly populations via other, unmeasured parameters such as foraging rates or survival, we suggest future fuel management in the area utilize a series of small (<50-m-wide) cleared patches interspersed with intact forest of the same dimensions or greater. Areas of this size are within range of the normal flight distances of *Argia vivida*, such that animals could easily access both daytime basking and night roosting habitat. Similar fuel management areas did not appear to have a negative impact on dispersal and were actually favoured as basking and foraging sites. The final phase of fuel treatments will incorporate these findings.

For rare populations, implementing fuel management activities in stages enabled interim monitoring to assess potential effects and allowed for subsequent modifications to the treatment plan. This approach has important applications for other rare species with habitats and dispersal corridors that fall within wildland/urban interface fuel treatment operations, for example, amphibians.

8. Effectiveness monitoring of fuel abatement treatments in southwest Yukon

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> Since 1980, Dr. Brad Hawkes has worked as a fire research officer for the Canadian Forest Service at Pacific Forestry Centre, Victoria, BC. He has done fire research in the areas of fire behaviour and danger rating, fire ecology, protected area fire management, and fire risk assessment. During the last 5 years he has been investigating the relationships between mountain pine beetle and fire in BC and AB (Waterton Lakes National Park). Brad has also been collaborating with the Yukon government on the design, application, and monitoring of fuel treatments that are intended to mitigate the risk of fire to communities, including those impacted by the recent outbreak of spruce beetle. Brad holds a B.Sc. in Forestry (UBC), M.Sc. in Fire Ecology (U of A), and Ph.D. in Fire Science (U of Montana). Brad is an Adjunct Professor at the UNBC and UBC. He is also a (retired) Registered Professional Forester in BC.

The southwest Yukon is currently experiencing a widespread outbreak of spruce bark beetle (*Dendroctonus rufipennis*) that started in the mid 1990s and is now 400,000 ha in extent. White spruce (*Picea glauca*) is the only conifer in this area. White spruce has experienced a high degree of mortality from the beetle. As a result, the outbreak has created extensive and contiguous areas of dead standing trees. In response to the increased level of fire hazard, a number of communities have been assessed for fire risk. Based on these assessments, some strategic fuel abatement treatments have been completed in wildland/urban interface zones. Monitoring fuel treatment effectiveness, especially in terms of reducing crown fire initiation and spread, is an important part of an adaptive management approach. This poster presents some key fire hazard attributes for pre- (reconstructed) and post-fuel treatment conditions to explore treatment effectiveness. There was a significant reduction in canopy bulk density and an increase in crown base height, and inter-crown separation, which should result in a reduction in crown fire initiation and spread. Future re-assessment of monitoring plots is recommended since windthrow and some additional beetle mortality of the post treatment trees may reduce fuel treatment effectiveness by increasing fine and coarse woody fuel loads. Future remeasurements of monitoring plots and determining changes in fire hazard attributes are areas for future research.

9. Prescribed burning in Mount Robson Provincial Park–Balancing biodiversity, habitat, forest health, and fuel management issues with terrain hazards

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Kirk Safford is a biologist with the BC Ministry of Environment. For the last several years he has worked on fuel management and prescribed fire in Interior Parks and Protected Areas as part of the BC Ministry of Environment's Mountain Pine Beetle Response Program. He recently moved to the Okanagan region and is now working out of the Penticton Ministry of Environment office as an ecosystem biologist.

Introduction

Established in 1913, Mount Robson Provincial Park is a Class "A" provincial park designated as a world heritage site by the United Nations. Between 1913–1915 much of the main travel corridor was burned during the construction of the railway. Subsequent fire suppression has resulted in the large, even-aged forest stands found today, which are not considered the historic composition and structure of forests within the park. The result is large tracts of high- to extreme-fire-hazard-rated forests, large stands of mature pine susceptible to mountain pine beetle, and limited biodiversity and habitat values. The Mount Robson Forest Health Strategy was developed to address the fire hazard, mountain pine beetle susceptibility, and biodiversity (seral stage targets). A series of treatment options were outlined, including mountain pine beetle fall and burn spread control, mechanical fuel reduction around campgrounds and facilities, and prescribed burn (Figure 1). The Moose Lake prescribed fire was successfully conducted in August 2004 (Figure 2). The Yellowhead prescribed burn was to be implemented in 2006; however, during the assessment process an issue over post-burn terrain stability was identified, and is the focus of this discussion.

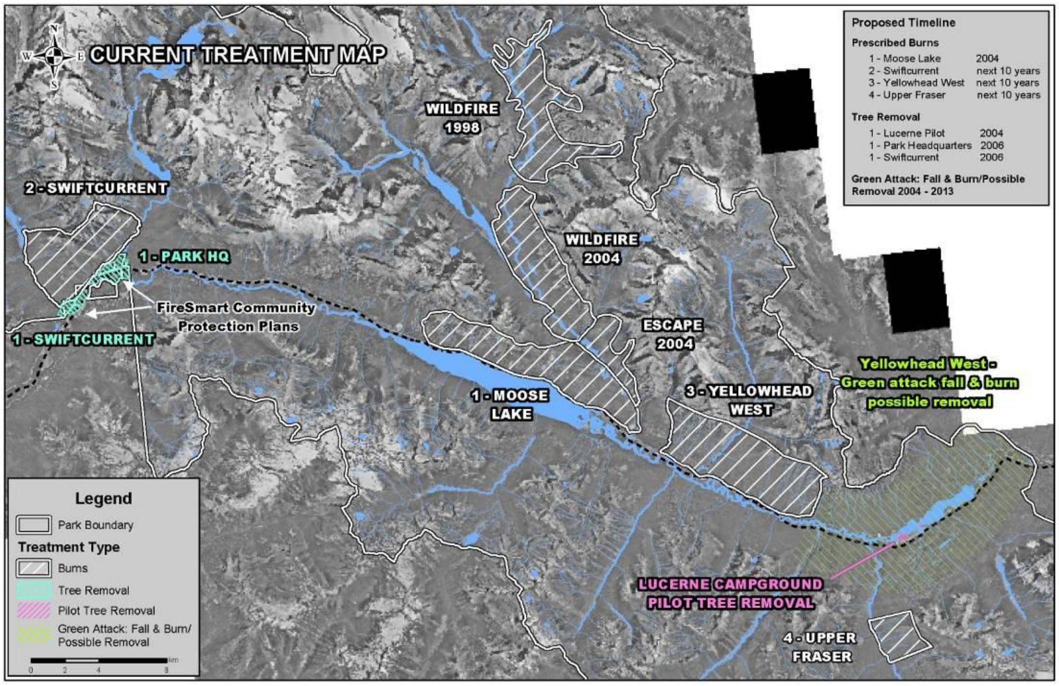

Figure 1. Mount Robson Provincial Park forest health treatment strategy (B.A. Blackwell).

Figure 2. Moose Lake prescribed fire, 2004.

The proposed 3100 ha Yellowhead prescribed burn is on predominantly south-facing slopes within the main transportation corridor of the park (Figure 3). The sub-boreal spruce (SBS) and Engelmann spruce-subalpine fir (ESSF) biogeoclimatic zones are represented within the prescribed burn area. The burn area ranges from approximately 1000 to 2300 m in elevation, with slopes up to 70%, and is characterised by moderate to deeply incised gullies (Figure 4). Below the base of the proposed burn area are the CN Railway, the Kinder Morgan pipeline, and Highway 16.

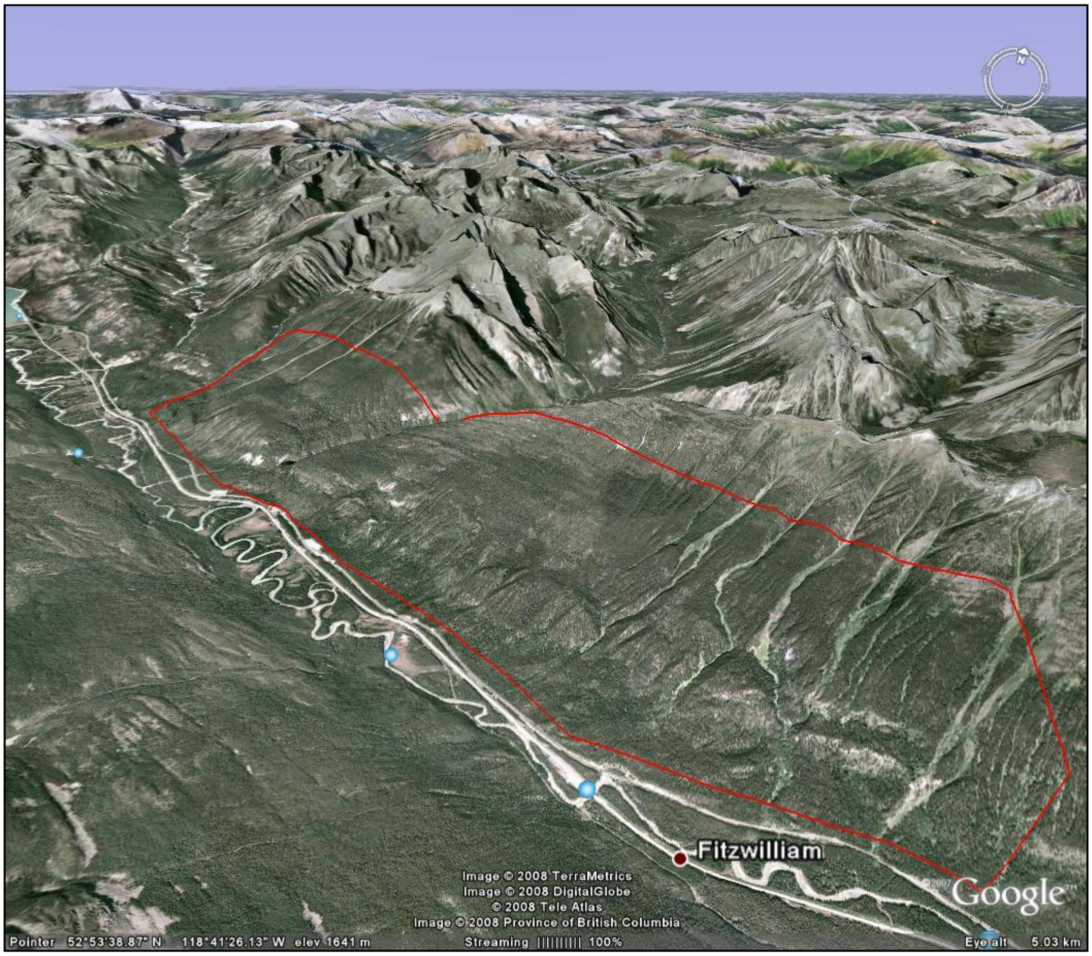

Figure 3. Proposed Yellowhead Prescribed burn (Google Earth graphic).

The objective of the prescribed burn was an intermittent crown fire resulting in 50–70% canopy mortality. Post-fire terrain stability and the risk to the down-slope infrastructure, were the primary determinants in whether the prescribed fire should proceed or not. Whether to risk wildfire or prescribed fire, and the BC Ministry of Environment's and stakeholders' risk tolerance of either event, were essential factors in the final decision on whether to proceed with the Yellowhead prescribed fire.

Assessments

The BC Ministry of Environment required geotechnical expertise and engaged consultants (Dobson Engineering Ltd.) to conduct a post-burn risk assessment of the proposed Yellowhead prescribed burn, and a brief assessment of conditions at the Moose Lake prescribed fire. The Moose Lake prescribed burn assessment was conducted to determine if water repellent soils had developed, if there were any terrain stability issues, and if they were a result of the prescribed fire.

Figure 4. Natural hazards: gullied terrain on the proposed Yellowhead prescribed burn.

Yellowhead post-burn assessment

The Yellowhead terrain hazard assessment was somewhat unique in that it was to assess risk prior to the burn taking place. The assessment reviewed geology; surface geology; climate; landslide history; drainage structure capacity of the railway, highway, and pipeline; and the hydrology of the burn area. The consultants conducted a risk analysis for slope hazards and hydrological events that could result after a prescribed burn. Several assumptions were required to model potential outcomes, including a 1 inch/hr rainfall event and complete hydrophobic soil development for the moderate to high burn scenarios.

The potential post-fire terrain stability events include slope failures, debris floods, and floods. The primary sources of initiation are a result of changes in hydrology and changes in soil conditions. The worst case scenario is hydrophobic soil development in which the soil becomes water repellent, resulting in extreme run-off events in average rainfall (e.g., Okanagan Mountain Provincial Park fire).

The Yellowhead terrain hazard assessment identified a 3–5 year post-burn risk window where soil properties would be affected by the fire. Under a low-severity burn scenario, there was predicted to be an approximate 31% increase in peak flow. A moderate- to high-severity burn that became water repellent could result in substantial overland flow during a rain storm event. Peak flow increase would be in the range of 460% under this scenario, placing down slope infrastructure, particularly the railway, at high risk to slope destabilization and/or debris floods in 11 of 15 sub-basins. Lastly, the assessment noted that the likelihood of a moderate- to high-severity burn as a result of a wildfire was potentially greater than under a prescribed burn designed for a low-severity burn.

The key recommendation of the Yellowhead terrain hazard assessment was that the severity of the fire could not exceed low. Furthermore, avoiding a moderate- to high-severity burn at mid and upper elevations was critical because most of the catchment area for theses drainages is in the upper half of the proposed burn area. Re-evaluation of the burn plan timing, indices, and staging was recommended. Should a moderate- to high-severity burn result, mitigative measures included constructing temporary earth berms, and installing early warning systems for the railway and highway.

Moose Lake prescribed burn assessment

The terrain hazard review of the Moose Lake prescribed burn determined that hydrophobic soils had not been created, and this burn was considered a low-severity burn for the purposes of the terrain assessment. Thus, the consultants concluded that a repeat of the Moose Lake burn was unlikely to result in hydrophobic soil development.

Concurrent with the terrain hazard assessment, the Forest Health Strategy's objectives for biodiversity, fuel management, and mountain pine beetle susceptible forests were reviewed to evaluate the need for the prescribed burn. Key to this review was an analysis of the Moose Lake prescribed burn and whether quantitative objectives were met. This included a review of seral targets, fuel, and mountain pine beetle host reduction objectives on the Moose Lake burn.

Analysis of the Moose Lake prescribed burn regarding Forest Health Strategy objectives arrived at the following conclusions:

- Biodiversity objectives for the park had been met in the ESSF, but were below target in the SBS.
- Susceptible pine had been reduced to below target levels (stems/ha) within the Moose Lake burn area.
- Forest fuel objectives to break up connectivity and reduce ground, ladder, and canopy fuels had been met. However, high snag density remained.

The decision-making process

The BC Ministry of Environment was left with a multitude of factors to consider in its decision to proceed, postpone, or abandon the Yellowhead prescribed burn. There were risks to downslope infrastructure with both the prescribed burn and the "do nothing" scenario of risking wildfire; these risks needed to be compared to the benefits achieved in meeting the Forest Health Strategy objectives in different burn severity scenarios. Finally, alternate mitigation options to meet the Forest Health Strategy objectives needed to be considered. The Yellowhead prescribed burn team, which included experts from BC Parks, Jasper Parks, BC Ministry of Environment biologists and hydrologists, and BC Ministry of Forests and Range Protection Branch staff and a geomorphologist, required an effective means to parse out the key factors on which to make a decision. This group had many demands on their time and the decision-making process needed to be efficient and clearly link back to the Forest Health Strategy direction.

A decision risk ranking tool was developed to identify outcomes from the management options of conducting prescribed fire, and the "no management action" risks of wildfire, increases in mountain pine beetle, and reduced biodiversity values. The risk (i.e., the probability and consequence of a given event), and our risk tolerance were queried for a series of risk statements (Table 1). Alternate mitigation treatment options were considered, and the benefits of these options were evaluated against the Forest Health Strategy objectives and the risk to infrastructure.

The risk statements were an important step to identify the scope of concerns amongst the working group and ensure team members were aware of these concerns. Concerns included risk of catastrophic wildfire, hydrophobic soil development, increased mountain pine beetle, significant weather events, reduction of biodiversity levels, and public and stakeholder perception of BC Park management activities.

Table 1. Example risk categories and statements for the Yellowhead prescribed burn risk matrix**.**

Risk Category	Risk Statement	Probability	Consequence	Risk	Tolerance
Wildfire	Present and future forest fuel loading results in a catastrophic wildfire (high severity) in 50 year period	Low	High	Moderate	Moderate
Prescribed fire	Prescribed fire results in terrain/hydrologic event in 5 year post fire period	Low	High	Moderate	Low
No management activity	No management activity results in increase in MPB infestation	High	High	High	Low

Key conclusions

Through review of the information provided by the assessment and the risk matrix process, the team concluded the following:

- If the prescribed burn were to proceed, the burn plan needed to be changed in order to ensure a low-severity burn at higher elevations. However, reducing the burn indices would result in ignition challenges that may require site modification at lower elevations, while ensuring a low-severity burn at high elevations could not be guaranteed. Finally, the objectives of reduced mountain pine beetle host, fuel reduction, and improved biodiversity would only be partially met due to a lower crown mortality burn.
- The risk of generating a catastrophic wildfire from the Yellowhead prescribed burn area had been reduced by the Moose Lake prescribed burn and Moose River wildfire. There is a high probability of success for suppressing a fire that starts in the Yellowhead area, and the addition of a fuel break on the east

end of the proposed burn will further reduce the risk of eastward travel of a wildfire.

- A prescribed burn would help meet early seral stage biodiversity targets in the SBS, however the preference would be to burn at a later date (10–20 years) to create a more uneven age class distribution in the Moose Lake, Moose River, and Yellowhead area.
- The prescribed burn would likely result in high snag density as in the Moose Lake prescribed burn. In 10–20 years the snags would fall, becoming a significant ground fuel, and combined with a young regenerating stand, would result in a high wildfire hazard and associated terrain hazards. The Moose Lake prescribed burn, Moose River wildfire, and proposed Yellowhead prescribed burn are all in close proximity and would have similar age class, and fuel hazard, through time (Figure 1). This would demand future maintenance burns.
- The “no management activity” option was not acceptable given the mountain pine beetle and wildfire management concerns.

Through evaluating the benefits and risks of conducting the burn, the decision was to postpone the prescribed burn, and re-evaluate in 10–20 years. In lieu of the burn, recommendations included assessing and placing fire guards to limit eastward travel of wildfire; continue the mountain pine beetle spread control program; place a weather station at the east park boundary; and continue to monitor terrain movement on the Moose Lake prescribed burn.

Lessons learned

- Avoid tunnel vision:
  - Consider the landscape-level implications of projects. Review the risks of project(s) outside the immediate project area.
  - Consider the long-term maintenance of management actions in interface areas. Future costs and resource demands will be required to maintain desired risk outcome.
- Identify stakeholders’ and your risk tolerance. Risk analysis can help to determine need and/or direct limited resources toward further assessment(s).
- The risk analysis helped put all team members on equal footing in understanding the level of risk(s).
- Re-evaluate stated objectives for management strategies. Are the same pressures present? And do they demand the same management action?
- Have quantitative management targets. This makes it easier to determine project and/or strategy status.

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10. Mythbusters: Communication programs within a community wildfire protection program

Ray Schmidt, Parks Canada Fire Communications Officer, Western and Northern Canada
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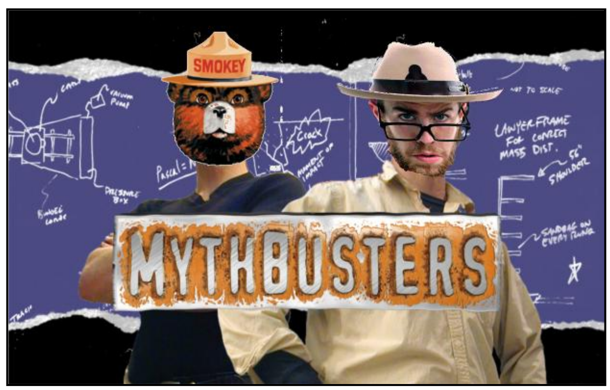
Ray Schmidt has worked for Parks Canada for the past 8 years. Although he witnessed community panic as ash rained down on Pelly Crossing, Yukon in 1997, it wasn't until 2003 when he was sandwiched between the Fairholme prescribed fire and Kootenay National Park's wildfires that he became fully involved. Since then he's been active with fire either operationally or with the communications team. He was Banff Park's Fire Communications Officer before accepting his current post as the Fire Communications Officer and chief mythbuster for Western and Northern National Parks.

Modern fire communications in the mountain national parks have developed since prescribed fires were first lit in Banff in 1983. Since then our program has evolved to include a concerted fuel reduction component for some of the communities in or near our parks.

All of our projects, whether a prescribed fire for habitat improvement, a fire to help reduce the risk of wildfire to Banff or Jasper, or a fuel reduction project, have employed some level of communication.



In its basic form, we attempt to bust myths. If you bust a myth in the right way to the right people, you can change your identified audience from being a non-supporter to a supporter.

Here are a few myths we've had to deal with over the years.

Myth: *Prescribed fire and fuel modification will kill our pristine forests. They can't stop fire and they certainly don't make forests healthier.*

Romantic perceptions of landscape factor heavily in the balancing act of support for prescribed fires.

Myth: *Modern equipment can suppress all wildfires, and besides it's not the homeowner's responsibility to protect their property.*

It’s really not improved fire suppression capabilities that will take fire management into the future…dealing with and making progress in human perceptions has a greater chance of making a difference.

Myth*: It can’t happen to us…*

The 2003 wildfires have been pretty good for helping us communicate our messages. They offer up the recent and geographically proximal example that might counter this myth. It’s not that it *can* happen to us, it *did* happen to us.

Communications approach

Jasper has recently enjoyed significant success in garnering support for their fuel reduction project. Their experience with open houses, planning forums, and information mail-outs, which are common means to gain support, wasn’t as successful as they desired. Sure, these types of events can satisfy your workplan, but often they don’t foster long-term support and understanding.

A local steering committee established by the town of Jasper was made up of members from a number of different sectors to provide recommendations. Their mantra became: “Instead of the community coming to you…go to them.”

They also came up with a unique name for their project: “Firesmart—ForestWise” and went out into the community. A key element was creativity. Their project improved the ecosystem, protected communities, and fostered overall community spirit!

Other products and activities used in the mountain parks are:

- photos
- ground tours
- staff training and creative education outreach
- information sheets
- signage
- serial-tours for stakeholders
- websites
- media

11. Using stakeholder input to measure fire consequences for wildfire risk assessment

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> Matthew has been working on a wildfire risk assessment of the southern Gulf Islands with Parks Canada for the last year and a half. He is a registered Forester in Training (FIT) and enrolled in the Masters in Resource Environmental Management program at Simon Fraser University. He has been working on resource inventory and management projects in BC for the past 10 years and has more recently found a passion for forestry and forest fire issues.

Wildfire risk assessment research has made considerable progress towards measuring the probability of fire, but comparatively little progress towards measuring the consequences associated with a potential fire. For example, many current risk assessments still apply a risk-equals-fire-probability definition and do not include fire consequences when identifying high risk areas (Brown 2003; Fiorucci *et al.* 2008; Haight *et al.* 2004). A risk-equals-probability approach has the potential to miss locations that have only moderate fire probabilities but very high fire consequences. The most advanced methods for measuring predicted fire consequences use local experts or community members to identify values at risk and weight them according to their relative importance (Alberta Ministry of Sustainable Resource Development 2004; B.A. Blackwell and Associates Ltd. 2006; Sanborn Total Geospatial Solutions 2006; Santa Barbara County 2006; Wallowa County 2006; Wildland Fire Associates 2008). This method becomes problematic, however, when there are more than two values at risk, as it is extremely difficult to accurately estimate the importance of each fire consequence relative to all other consequences.

I describe a method which, by using stakeholders to measure fire consequences, offers greater accuracy and precision than existing forest fire risk assessment methods and apply it to the southern Gulf Islands, British Columbia, Canada. The southern Gulf Islands hosts a mosaic of rural residential areas and some of Canada’s most endangered forested ecosystems. This combination of extensive rural development among endangered forest ecosystems makes an ideal location for studying forest fire consequences.

This method also offers a quantitative approach for determining the complex relationships of importance between a variety of fire consequences such as the protection of human life and endangered species. The method uses a survey and conjoint analysis to provide an understanding of how stakeholders rank tradeoffs such as: How much more important is the loss of a local endangered species than the loss of 10 houses? It was expected that stakeholders representing the Gulf Islands National

Park Reserve would value ecological values at risk more than local fire protection staff. This was not the case. Respondents consistently felt that a fire with a major potential for loss of life was about three times worse than major damage to 10 houses and 4.5 times worse than the loss of a rare species. Of note is that ecosystem damages due to fire were of very little importance to respondents. I believe this was because ecosystem damages due to fire are poorly understood by many stakeholders and not incorporated into provincial, federal, and local agency policy.

The survey results were combined with values at risk mapping and predicted fire intensities to create a detailed fire consequences map of the southern Gulf Islands. The locations with the highest consequence ratings are those where multiple values are at risk. These are generally residential areas with problematic evacuation that are predicted to sustain moderate or high intensity fires. The second highest rated locations are those with evacuation problems and moderate to high fire intensity. Following these locations are residential areas with moderate to high fire intensity, plus known locations of endangered species.

This quantitative method of measuring values at risk is most appropriate when there are a variety of stakeholders and values at risk in the risk assessment area; an accurate measurement of fire consequences is needed; and stakeholder participation in fire management is desired. Using this quantitative approach allows stakeholders representing a variety of institutions to work together to come to a common understanding of the values at risk from wildfire. This collaborative approach is widely recognized by governments as important to the long-term success of community wildfire protection projects (United States Government 2002).
The provincial government, local fire halls, and Gulf Islands National Park all share responsibility for forest fire management in the southern Gulf Islands and will be working together on this issue in the future.

This common understanding of values at risk will be helpful as stakeholders collaborate in the future to develop fire management strategies that mitigate risk. Perhaps most importantly, this method promotes stakeholder support for community wildfire protection and associated ecosystem restoration projects by incorporating stakeholder opinions of values at risk into a wildfire risk assessment (Ludwig 2001).

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12. Revisions to the Open Burning Smoke Control Regulation

Rebecca Freedman, Environmental Management Analyst, Air Protection, BC Ministry of Healthy Living and Sport
Rebecca.freedman@gov.bc.ca

Rebecca Freedman works at the BC Ministry of Healthy Living and Sport in the Air Protection section. Rebecca is leading the review and revision of the Open Burning Smoke Control Regulation, along with a team of regional experts. She also leads other provincial programs to reduce wood smoke impacts on human health, including the Provincial Wood Stove Exchange Program and Burn It Smart education campaign. Rebecca received her Master of Environmental Studies degree from York University with a focus on communication and education, and behaviour change.

The BC Ministry of Environment intends to review and revise the Open Burning Smoke Control Regulation (OBSCR) under the *Environmental Management Act* (*EMA*). The review process supports the ministry's commitment to continuous improvement and to regularly review regulations in order to revise provisions as appropriate.

The Open Burning Smoke Control Regulation governs burning of vegetative material associated with a range of activities, including land clearing and forestry-related resource management. It sets out the conditions under which the open burning of vegetative debris can be authorized. This regulation has not been substantively revised since the regulation was enacted in 1993.

The ministry intends to revise the regulation to establish a comprehensive province-wide framework of three “smoke sensitivity zones” (high, moderate, and low). Each zone will have specified and consistent standards for parties considering the open burning of vegetative debris. The regulation will also enable a clear and consistent “single window” system for stakeholders to access information and register open burns that meet the standards set out in the regulation. This risk-based, province-wide approach supports the ministry’s primary objective of reducing or minimizing impacts to human health as well as related objectives such as enabling and encouraging compliance, minimizing undue costs, and promoting equity and consistency.

This regulation will attempt a difficult balancing act between the noble goals of healthy air *versus* the noble goals of burning for fuel management and ecosystem restoration. The intent of participation in both the poster session and presentation discussion was to provide for information exchange; primarily between individuals or agencies who conduct burning for land clearing, fuel management, and other prescribed activities; and ministry staff involved with the OBSCR revision. While the regulation revision process in nearing completion, comments received at the conference were collected and reviewed for potential additions or changes to the final draft.

Relevant reading

http://www.env.gov.bc.ca/epd/codes/open_burning/pdf/obscr-paper.pdf

13. Wild fires and tame wildlife: Tales of weirdness from the Rocky Mountain Whooey

Dr. Cliff White, Environmental Sciences Co-ordinator, Banff National Park , AB
cliff.white@pc.gc.ca

Cliff has worked with Parks Canada since 1973 in various positions including fire crew member, backcountry park warden, and public safety warden. From 1980 to 1986, his BNP vegetation/fire team spent some quality time "learning to burn" with BC's Cranbrook District fire and range management staff. They then took this knowledge back to Parks Canada to initiate a prototype fire management program that required extensive testing of high intensity prescribed fire. Cliff's doctoral research (PhD from UBC, 2001) was part of an interdisciplinary project on the long-term interactions between humans, fire, wolves, elk, and trembling aspen on the Rocky Mountain's east slope.

From 1987 to 1990, Cliff was the Parks Canada National Fire Management Co-ordinator in Parks Canada's Ottawa headquarters. His current research in Banff centres on the regional ecosystem effects of recent major changes in predator and prey populations, combined with large-area prescribed burns.

Dr. White's presentation was held on the evening of November 5, and was open to the general public as well as the conference participants. He spoke about the difficulties encountered during the early days of prescribed burns in Banff National Park (1990s), and how the modern program is altering vegetation patterns, wildlife numbers and use patterns, and the predator-prey balance, to a regime that more closely resembles the Bow Valley ecosystem before fire suppression. He also told us about a trip to Tuscon, Arizona, and how what he saw there compared to the fire activities underway in Banff.

Prescribed burn above Banff townsite.

14. Funding your community wildfire protection project

Presenters were:

Mark Fercho, Integrated Community Sustainability Planning Leader, Prince George, BC
mfercho@city.pg.bc.ca

Mike Dittaro, Superintendent, Fuel Management, BC Ministry of Forests and Range, Protection Branch, Vanderhoof, BC
mike.dittaro@gov.bc.ca

Sue Clark, Union of BC Municipalities, Programs Officer, Local Government Program Services, Victoria, BC
sclark@civicnet.bc.ca

> Mark Fercho works for the City of Prince George as the Integrated Community Sustainability Planning Leader, and he previously managed the city's environmental programs including city parks and horticulture, urban forestry, air quality, stream stewardship, climate change/greenhouse gas/energy management, and other duties.
>
> Mike Dittaro, with over 32 years of experience with the BC Ministry of Forests and Range, works with local governments, the Union of BC Municipalities, First Nations, consultants, and fire suppression personnel to reduce forest fuel accumulations adjacent to the Wildland/Urban Interface.
>
> Sue Clark is a Program Officer for Local Government Program Services at the Union of British Columbia Municipalities. Sue is responsible for a number of provincially funded grants intended to address shared provincial/local government priorities, including the administration of the Strategic Wildfire Prevention Initiative.

Mark Fercho's presentation featured the Community Wildlife Protection Plan for the City of Prince George. Under Mark's management, the urban forestry program responded to a major mountain pine beetle epidemic in the city, requiring a major dead tree removal and forest fire fuel reduction program from 2003 to 2008 (Figure1). The plan can be viewed at:
http://www.city.pg.bc.ca/rec_culture/parks/urbanforestry/wildfire/

Prince George's urban forest management and mountain pine beetle information is posted at:
http://www.city.pg.bc.ca/rec_culture/parks/urbanforestry/

Figure 1. City of Prince George, before (2003) and after (2006) fuel reduction program.

Mike Dittaro spoke about the role of his agency in assisting local governments to achieve their fuel management goals in the interface. Details about the information he presented, can be found at the BC Ministry of Forests and Range, Fuel Management website: http://ground.hpr.for.gov.bc.ca/ This website has a wealth of information on fuel management, the Community Wildfire Protection Planning, funding, and much more.

Throughout the conference presenters emphasized the need for a communication plan for a fuel management program. The Fuel Management website includes a 10 page "Fuel Management Communications Plan for Local Governments," which would make a good template for communities: http://ground.hpr.for.gov.bc.ca/files/CP_municipalfuelmanagementtemplate_final.doc#_Toc120525536

Mike's presentation included a video clip supplied by Dave Schroeder of FPInnovations, Wildland Fire Operations Research Group. The video captured a demonstration burn at Fort Providence, NT and is part of a project to study the effectiveness of FireSmart treatments.

Dave Schroeder's website at http://fire.feric.ca/about/DaveSchroeder.asp includes a project report for an earlier burn done at this site, *Effectiveness of forest fuel management: A crown fire case study in the Northwest Territories, Canada*. The report for the burn captured in the video will be on Dave's website in spring of 2009.

Dave Schroeder's contact information is:
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780-865-6980

FPInnovations, Alberta Sustainable Resource Development, and the Government of the NWT are producing a video, with narration, that will include content similar to the clip screened by Mike Dittaro. They plan to have the video available through Partners in Protection (http://www.partnersinprotection.ab.ca).

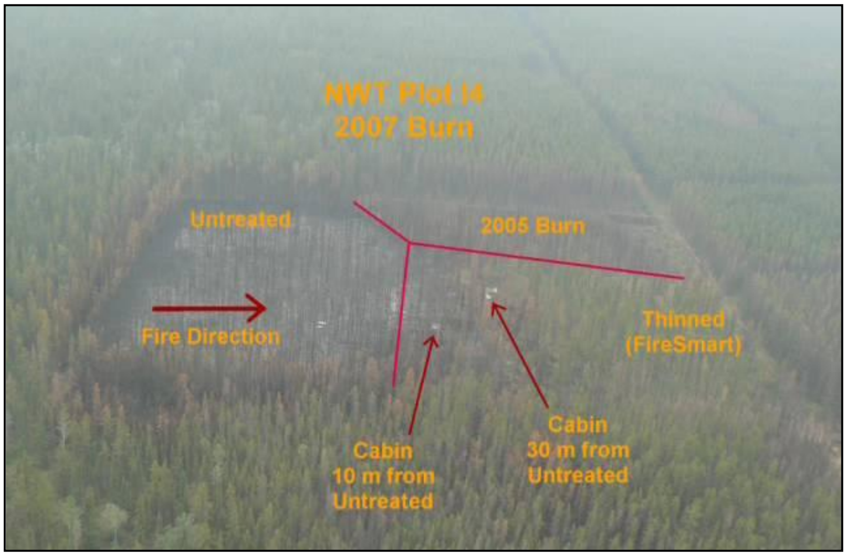

Figure 1. Photo from movie clip (Dave Schroeder, FPInnovations).

Sue Clark's presentation was about funding alternatives for local governments undertaking strategic wildfire prevention initiatives. The following points are taken from her PowerPoint slides:

Funding programs available through the Union of BC Municipalities include:

- Community Wildfire Prevention Plans
- Pilot projects
- Operational fuel treatments

This funding comes from the BC Ministry of Forests and Range, but it is administered by the Union of BC Municipalities. Technical expertise is provided by the BC Ministry Forests and Range's Protection Branch.

Funding for First Nations in areas affected by mountain pine beetle is also available through these programs. The Union of BC Municipalities administers the funds. However, First Nations applications are managed through First Nations' Emergency

Services Society, and technical expertise is also provided through First Nations' Emergency Services Society.

Funding opportunities through Natural Resources Canada are:

- Preparation of Community Wildfire Protection Plans
- Development of fuel management prescriptions
- Implementation of operational fuel management treatments

Community Wildfire Protection Plans

The Community Wildfire Protection Program is a planning tool that will assist communities in assessing risk of wildfire and enhancing community protection.

- A Community Wildfire Protection Plan is a prerequisite to operational funding for both the Natural Resources Canada and Union of BC Municipalities funding programs.

Both the Union of BC Municipalities and Natural Resources Canada have funding for development of a Community Wildfire Protection Plan.

- The Union of BC Municipalities funding for Community Wildfire Protection Plans is available to all local governments.
- Natural Resources Canada funding is only available for those areas affected by mountain pine beetle.

In areas not affected by mountain pine beetle, the Union of BC Municipalities will fund up to 50% of the cost of the plan to a maximum of $15,000. The community contribution may be in-kind. Regional districts can apply for additional funds if required.

In areas affected by mountain pine beetle, both the Union of BC Municipalities and Natural Resources Canada may contribute to the development of a Community Wildfire Protection Plan to reduce the cost to the community.

- The Union of BC Municipalities funds 50% of the cost of the plan.
- Natural Resources Canada funds 25% of the cost of the plan.
- Using both sources of funding, community contribution is 25% of the cost of the plan.

Funding of operational treatments

- For treatments of areas not affected by mountain pine beetle, the Union of BC Municipalities will fund at 50/50.
- Natural Resources Canada does not have a program for non-MPB lands.
- Funding levels are approved on a cost per hectare basis rather than a maximum grant amount.

- In areas affected by mountain pine beetle, Natural Resources Canada funding can be used to complement the UBCM program.
- In areas affected by mountain pine beetle, Natural Resources Canada can provide up to $100,000 per community per fiscal year to support fuel management activities.
- As in areas not affected by mountain pine beetle, the Union of BC Municipalities funding is approved on a cost per hectare basis, rather than a maximum grant amount.

Operational fuel treatments in stands affected by mountain pine beetle:

- Union of BC Municipalities funding: Up to 75% of the total project cost on local government and/or provincial Crown land
- Natural Resources Canada funding: Up to 100% of the cost of the portion on local government land to a maximum of $100,000

To maximize grant effectiveness:

- Apply for mountain pine beetle program funding to do eligible work on lands of local government jurisdiction
- Apply for Union of BC Municipalities funding to do eligible work that extends to provincial Crown lands
- Use the mountain pine beetle program funded work to leverage funds from the Union of BC Municipalities program.

Applying for funding

Detailed information on fuel management project funding is available on line at http://ground.hpr.for.gov.bc.ca

How to apply for Natural Resources Canada funding:
http://mpb.cfs.nrcan.gc.ca/protect/community/wildfire_e.html

Applications are taken on a continuous basis.

Contact information

Sue Clark
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Dave Harrison
Mountain Pine Beetle Program, Natural Resources Canada
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15. City of Nelson: Operational Readiness Plan 2008

Simon Grypma, Fire Chief, Fire and Rescue Services, City of Nelson, BC
fire-rescue@city.nelson.bc.ca

In the absence of a previously scheduled speaker, Simon Grypma kindly stepped in to present his talk on the Operational Readiness Plan for the City of Nelson. This plan addresses procedures in the case of a wildland fire. For information about the availability of a digital version of the complete plan, contact Simon at the above email address.

Operational Plan outline

Overview

- This is the overall purpose or objective of the plan; it includes general statements about the overall plan. It may include the intelligence used to develop the plan.

Command

- Describe the type of command organization to be used. Who is involved in a command role when the plan needs to be implemented? Include the location and responsibilities of command personnel.

Co-operators

- List all co-operators involved in the plan and contact numbers or notification for involvement. Also, list the functional role of those involved.

Tactical area

- General description of the area and/or description of property or resources affected. This may include tactical resources or locations such as staging areas and water sources.

Triggers

- Identify the criteria to initiate actions or contingencies of the plan. If more than one, identify criteria and contingency for each scenario. Include map identifying triggers.

Protection priorities

- Identify any priorities relating to the plan and list priorities in order of importance.

Structure triage

- Identify method of triage and method of triage identification, then determine resource needs based on triage.

Evacuation plan

- Identify stages of evacuation notice and determine the level of evacuation and resource needs based on triggers or contingencies. Identify shelter locations for evacuated public.

Resources

- Identify resources needed for each trigger or contingency of the plan. Determine response time and method of notification.

Mapping

- Include map of the general area of the overall plan. Also, include maps for traffic flow, evacuation, and tactical response. Include detailed maps of structural triage.

16. Fuel management in the wildland/urban interface: Effects on wildlife habitat and biodiversity

Dr. Walt Klenner, Wildlife Habitat Ecologist, BC Ministry of Forests and Range, Kamloops, BC
walt.klenner@gov.bc.ca

Walt Klenner is a wildlife habitat ecologist with the BC Ministry of Forests and Range and is based in Kamloops. Since 1991, he has worked on evaluating the response of a wide range of terrestrial vertebrates and invertebrates to habitat changes at three large-scale silvicultural systems sites in wet cold ESSF forests and dry Interior Douglas-fir forests. Current work focuses on field studies on the species composition and productivity response of vegetation to disturbances, quantifying small mammal abundance in relation to harvesting in dry Douglas-fir forests, and quantifying landscape (using TELSA) and stand-level (using TASS) habitat supply in relation to management and natural disturbances.

Fuel management in the wildland/urban interface has become an increasing concern in the last decade and although the efficacy of fuel management treatments under extreme fire hazard conditions remains uncertain, there is emerging consensus that fuel management treatments can play a key role in diminishing the risk to communities posed by wildfire under moderate to high fire hazard conditions. But what are the likely effects of a wildland/urban interface fuel management program on wildlife and biodiversity? This issue is complex and cannot be addressed unless the nature and extent of the of the fuel management treatments are known and placed in the context of management in surrounding forests and grasslands.

Maintaining habitat diversity is a basic, “first principle,” key approach to maintaining diverse wildlife and biodiversity, hence, there is good reason to believe that even aggressive treatments of crown and ground fuels in specific areas can play a positive role in creating and maintaining wildlife habitat, especially for species that require open forests with vigorous grass, forb, and shrub understories. Where prescribed fire is involved in fuel management, the ability to retain downed wood and crustose lichens, and to prevent the invasion by invasive plants, remains a challenge.

Quantifying the effects of wildland/urban interface fuel management initiatives on wildlife habitat will require the nature of the treatment to be identified, the likely short- and long-term effects on forest or grassland structure to be determined, and a land use planning framework developed to evaluate the context and likely value of the treatments to wildlife and biodiversity.

17. Ecologically based guidelines for fuel management in the wildland/urban interface: Optimizing conditions for wildlife

Alan Westhaver, Vegetation/Fire Specialist, Parks Canada, Jasper National Park, AB
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Alan Westhaver has devoted much of his past 29 years as a Park Warden to varied aspects of ecosystem restoration, prescribed fire, and fire protection. As former president of Partners in Protection, he chaired the working group that prepared *FireSmart: Protecting Your Community from Wildfire*, now the Canadian standard for risk management in the wildland/urban interface. The lack of ecologically based approaches for fuel manipulation was recognized at that time. To address this deficiency, the "FireSmart—ForestWise Communities Project" was initiated in Jasper through a partnership with the Foothills Model Forest and the University of Calgary. The objective of that project is to develop, implement, and assess ecologically based approaches for reducing interface wildfire threats in ways that also optimize benefits for ecosystems and wildlife—and are supportable by the public. As an offshoot to that project Alan obtained his Masters of Science degree in 2006, building on earlier undergraduate degrees in wildlife biology and forestry (range management) from the University of Montana. He lives with his wife and three daughters in Jasper, Alberta.

Introduction

Canada is experiencing an increase in interface fires. Western Canadian wildland fire managers and researchers have observed disturbing changes in the structure and density of forests formerly subject to frequent disturbance by fire, an upsurge in wildfire intensity at these locations, and a corresponding increase in the difficulty of wildfire control (Quintilio 2005). Several factors combine to underpin the need for more effective community wildfire protection:

- Increasingly dense country residential development (Duke *et al.* 2003)
- Growing risk of human-caused ignitions
- Warmer climate resulting in increased frequency, size, and severity of wildfires (Flannigan *et al.* 2003)
- Rising socio-economic costs of fire control (Filmon 2004)

Current standards for interface fuel management were developed by the non-profit organization "Partners in Protection" (http://www.partnersinprotection.ab.ca) and first published in the manual *FireSmart: Protecting Your Community from Wildfire* (2006) in 1999. The purpose of standards is to limit wildfire intensity, ease fire suppression efforts, and prevent structural ignitions.

Overall, Canadian fire protection agencies are meeting with limited success in convincing individuals or communities at the interface to voluntarily modify or manipulate forest structure on and around private property (Province of British

Columbia 2001; DeSorcy 2001; Filmon 2004). Evidence is building that recurrent conflicts between existing standards for risk/fuel reduction and other resource values such as wildlife conservation may deter interface residents or communities from taking preventive actions. Graham (2003) listed privacy, wildlife viewing, recreation, aesthetics, and ideas of naturalness as the key landscape values that influenced the acceptability of fuel management activities. In Jasper, residents held similar concerns. Such controversies suggest deficiencies in current approaches to residential wildfire protection. Evaluation of current FireSmart standards reveals a pre-occupation with physical characteristics of the fuel complex, and disregard for other resource values such as wildlife, biodiversity, and aesthetic qualities.

In view of this, fuel reduction treatments have improved chances of being implemented if managers provide effective responses to the objections and concerns of residents (Winter *et al.* 2002; McCaffrey 2004). This was a primary motivation for this research. For Parks Canada, it is also important to avoid wildlife/human conflicts, maintain grizzly bear habitat values, and provide connectivity and corridors so that wildlife, particularly carnivores, is able to move freely through the landscape.

The primary purpose of this research was to develop, implement, and recommend practicable, ecologically based approaches for managing vegetation at the wildland/urban interface in ways that optimize conditions for wildlife, within constraints of current fuel treatment standards (Westhaver 2006). The resulting techniques have been applied to nearly 1000 ha of dense "montane" forest comprised of a wide range of lodgepole pine, Douglas-fir, white spruce, and mixed-forest types historically adapted to frequent, low-intensity surface fire or mixed-intensity fire (Tande 1979; Achuff 1996; Andison 2000).

Methods

This study employed a combination of literature review, experimentation learning through adaptive management (Walters and Holling 1990), and deductive analysis to develop innovative fuel treatments that better accommodate wildlife while managing interface vegetation to reduce wildfire risk. Improved fuel treatments were applied manually by labour crews and mechanically by specialized forest industry contractors, then evaluated and refined by Parks Canada. The work began in 2003 and continues to present. This approach was adopted as the best means of achieving the goals of this study and overall risk reduction objectives at Jasper, given the constraints of time—and the near absence of reproducible scientific studies specific to fuel treatments in the wildland/urban interface. Figure 1 summarizes the sequence of analytical steps employed to achieve the study purpose.

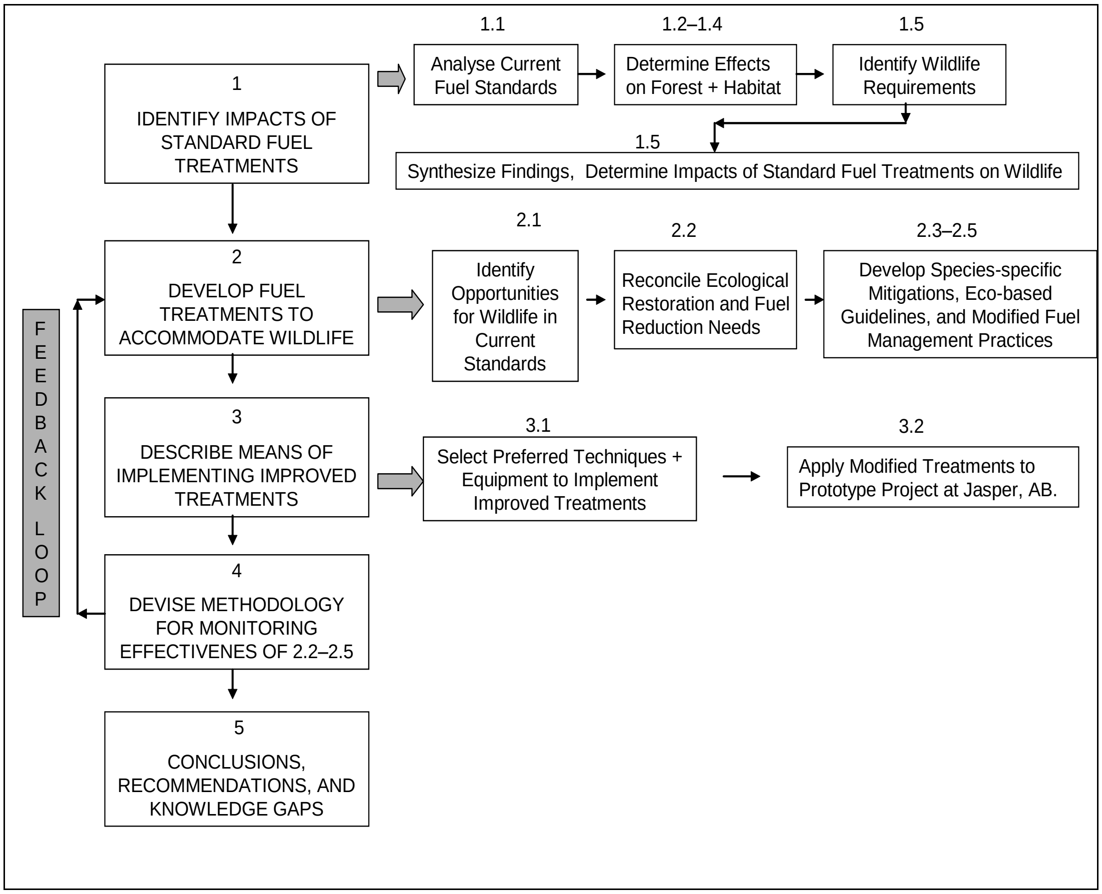

Figure 1. Schematic of research methods.

The key principles of wildland fire behaviour (Van Wagner 1977; Forestry Canada Fire Danger Group 1992; Cruz *et al.* 2002) and home ignition (Cohen 2000a, b; Cohen and Stratton 2003) were reviewed at the onset of the study. This was done to avoid violating the intent or efficacy of existing fuel treatment standards when proposing more environmentally sensitive methods.

Extensive literature reviews were conducted:

- To identify potential impacts of fuel treatments on abiotic forest components (e.g., insolation, temperature, wind flow, effective precipitation, relative humidity, soil moisture, and soil nutrient status)
- To document the habitat roles of each (eight) fuel bed strata, and to predict the direct and/or indirect effects of fuel treatments on each layer
- To determine how fuel management treatments alter important habitat features

Habitat trees, forest edge, coarse woody debris, and wildlife corridors were chosen as important habitat attributes, and grasslands, aspen forest, and wetland/riparian areas were selected as being significant habitat types for the purpose of this analysis. The potential impacts of fuel treatments on 41 species of wildlife common to the interface were evaluated. Selected species included 4 cavity excavators, 8 songbirds, 6 raptors, 12 small mammals, 1 bat, 6 carnivores, 3 ungulates, and 1 amphibian.

Current fuel reduction standards were examined, by fuel bed layer and interface Priority Zone to discern prospects for incorporating measures that could improve wildlife and habitat quality, or at least reduce adverse impacts, without reducing effectiveness of fuel treatments. Finally, once potential mitigations for protection of wildlife and habitat were identified, these were incorporated into prototype fuel treatments and presented in the form of "operational prescriptions" unique to each forest type in the study area.

Results

Numerous opportunities for maintaining or enhancing wildlife conditions within the constraints of current fuel treatments were identified after examining FireSmart standards. Five strategies were identified for managing the forest canopy to benefit wildlife:

1. Variations of single-tree thinning
2. Cluster thinning
3. Selective preservation of habitat trees
4. Stand type conversion
5. Selection for prevention of post-treatment windthrow

The opportunity analysis was carried out through other fuel bed/forest layers and yielded many more prospects for wildlife in treated fuels (Westhaver 2006). Due to stricter needs for fuel removal close to structures, opportunities increased with increasing distance from structures. Detailed information about FireSmart fuel standards, literature reviews, and step-wise analyses of impacts of fuel treatments on abiotic forest components and biological attributes of fuel beds, and the impacts of fuel treatments on 41 species of birds, mammals, and amphibians common to wildland/urban interface areas are found in Westhaver (2006).

Species-specific mitigations for wildlife and habitat conservation

A key result of this study was to synthesize information about the life cycle and habitat needs of wildlife common to the interface, and identify species-specific mitigations to minimize the impact or obtain benefits within the context of current fuel treatments. Overall, protection of habitat trees, coarse woody debris, and structural diversity within stands are the most significant mitigation factors. Species-specific mitigations were refined during several operating seasons of the Jasper prototype fuel management project to ensure their practicability. The full set of wildlife habitat requirements and mitigations are summarized in seven tables, and are presented in Westhaver (2006). See Table 1 below, for a sampling of these results.

Table 1. Example habitat requirements and mitigations to minimize impacts of fuel management or obtain benefits for interface wildlife.

Species	Habitat requirements	Mitigations to minimize impact or obtain benefits
Pileated Woodpecker	Widespread, but relatively uncommon year round resident of most Canadian forests; has a large territory; needs minimum 33 cm Diameter at Breast Height (DBH) snags or live trees with decay for excavating nests and roosts; ants and insects in trees and logs are main year round food; uses live hollow or decaying trees for drumming; attracted to sheltered clumps of dead trees and downed logs	Retain a mix of forest ages and types in the region; retain 12–15 snags and 12–15 living trees with decay (legacy trees) per hectare of all diameters, species, and sizes with bias towards large diameter (>33 cm DBH) trees; broken-top trees most important; use cluster thinning technique to retain cover adjacent to habitat trees; retain trees infested with ants and other insects; retain up to 50 logs/ha on ground (long and large is best) and extra snags for forage and future downed logs; keep tall stumps of all sizes; survey areas for active use by woodpeckers first
Black-capped Chickadee	Common year-round resident Canada-wide; feed by gleaning insects and insect eggs from bark, twigs, boles, and foliage of trees and shrubs from ground to crowns; seeds and berries augment diet; can excavate nests in rotted wood; use existing cavities/hollow trees; stubs are important nest sites; select nest trees < or = 10 cm DBH, often in open areas; roost in cavities or dense conifers out of wind	Retain or create a variety of dead or dying trees of different diameters and species for nesting and foraging; preserve broken-topped trees, even short stubs; thinning will encourage seed sources from native flowering plants and berry production; augment these with planted landscapes around home and/or bird feeders; preserve shelter around habitat trees and small clusters of conifers for roosting out of the wind and rain
Red-backed Vole	Common in boreal and mountain forests across Canada; closely linked with moist, mossy, and mature conifer forest; downed woody material very important for cover; feeds heavily on mushrooms associated with decaying wood; also eats seeds, insects, and berries; uses squirrel middens; key prey for many species	Leave abundant coarse woody debris, large logs, small brush piles, and decaying matter to foster fungus foods and provide shelter and moisture; use cluster thinning and protect shrubby understorey to preserve pockets of dense forest and shaded sites; limit thinning in moist forest areas where possible; protect squirrel middens

Weasel	Coarse woody debris provides access to under-snow environments and cover for potential prey species; most common in regenerating forest and grassy areas suited to prey species, and residual trees	Leave abundant coarse woody debris, large logs, and small brush piles where possible, to foster abundant prey and provide cover; leave protruding debris to provide access routes and under-snow travel routes; use cluster thinning and protect shrubby understorey to preserve pockets of dense forest and shaded sites; protect squirrel middens
White-tailed Deer	Found across Canada in grassland, parkland, and boreal mixed forests; spring and summer diet mostly flowering plants and grasses; browse on deciduous trees and shrubs in winter; mostly inhabit forest edges to feed in open and seek cover in forest and shrubs; small conifer thickets are winter refuge	Interface areas can provide forest edge favorable to white-tailed deer; encourage and preserve deciduous shrubs and aspen during thinning; open canopy will increase summer forage availability; preserve thickets of coniferous saplings in deciduous/mixedwood forest for cover (to reduce fire spread remove mature conifers that overtop regenerating trees)

Ecologically based fuel management guidelines, by Priority Zone and fuel bed strata

For each interface Priority Zone and within each of the eight fuel bed strata, we developed and field-tested ecosystem-based fuel treatment guidelines for benefits to wildlife or reduction in potential adverse impacts of fuel management activities.

In Priority Zone 1, these guidelines provided: for preserving or planting deciduous trees to provide important seasonal habitat; measures to allow selective retention of existing snags and creating additional snags by topping mature conifers; suggestions for preserving "feature" trees while reducing ignition potential; for managing native shrubs to optimize forage, shade, and cover for wildlife; for cultivating fire-resistant ground covers; and for preserving isolated pieces of coarse woody debris (i.e., logs).

Even more extensive opportunities for accommodating wildlife are possible in Priority Zones 2 and 3. Guidelines to identify and preferentially retain deciduous trees, long-lived tree species, and individuals with windfirm traits are presented. Trees with twin, multiple, and broken tops or fire scars should be retained since these deformities, and associated decay, make these trees highly suitable for wildlife nesting, roosting, and feeding sites. Exceeding the single-tree spacing standards is recommended to create forest gaps or open forest habitats that provide habitat diversity while further decreasing fuel continuity, which significantly reduces fire spread rates while increasing ease of fire control. All habitat trees with nests and cavities should be preserved. Wildlife use can be increased by pairing habitat trees with living trees, or by preserving clusters of habitat trees. A minimum of 12–15 snags/ha should be retained for optimal wildlife conditions. In the forest understorey, rather than removing all coniferous regeneration, overtopping mature trees can be removed in some cases to provide increased wildlife cover and security while also allowing for long-term tree replacement and seral succession. At least 25–350 linear metres of logs should be left on the ground, with preferential protection for older, larger, and more decayed individuals.

Combining fuel management and ecological restoration

The potential for achieving ecological restoration concurrent with measures for community wildfire protection was also investigated. There are strong similarities between the solutions required to resolve ecological problems in fire-dependent forests such as forest in-growth, forest encroachment, and replacement of deciduous species by conifers, and fire protection issues caused by hazardous fuel accumulations. By selectively thinning the forest canopy to restore stand structure and composition to within their historic ranges of variability, the net effect is also to reduce wildfire risk, sometimes to levels below what can be expected by applying FireSmart standards alone. These overlapping objectives did not extend to even-aged lodgepole pine forests initiated by stand-replacing fires. In these stands, prescribed thinning standards result in habitat conditions that depart from historic norms, but may still benefit wildlife. For example, marten may find more meadow vole prey within thinned stands—but the density of red squirrels in the interface zone is likely to be less than found during pre-treatment levels.

Discussion

Developing guidelines and mitigations by adaptive management, during an operational fuel management project, proved to be a very effective method for testing and refining practicable solutions. This approach allowed continuous exchange between researchers and manual crews, specialized forestry contactors, and equipment operators responsible for implementing the solutions. That feedback resulted in many practical improvements.

Our assessment of potential ecological effects of standard fuel treatments revealed that manipulating fuel load, arrangement, and size distribution also resulted in substantial alterations to key wildlife habitat qualities. Specifically, we noted that fuel treatments directly or indirectly affected most aspects of forest structure, forest composition, and forest function, and that these effects can lead to a wide range of adverse impacts upon wildlife and wildlife habitat. As a corollary, we also concluded that knowledge of these effects was useful to guide fuel manipulation programs in a more informed way, thus allowing adverse impacts to be avoided and potential wildlife benefits to be realized.

Existing literature provided sound information about life requirements for wildlife. However, we found that most literature concerning wildlife response to forest disturbance was related to major events such as clearcut logging or wildfire, but there are few studies, and little experimental data, to verify the response of wildlife to fuel treatments that leave significant canopy cover, a less severe form of disturbance. Our forecasts of potential impacts of fuel treatments were hampered by this knowledge gap. The ability to provide benefits for habitat and wildlife varies between vegetation and fuel types.

Through this research, it is hoped that wildland and municipal fire managers will expand their dominant viewpoint of "vegetation as fuel" with a more holistic perspective of vegetation as the basis for wildlife populations and other social or ecological values held by interface residents. In this way concerns of interface residents can be addressed, and a significant barrier to fire prevention removed.

Acknowledgements

I wish to thank Parks Canada and the Foothills Model Forest for encouraging this research. Also, my sincere gratitude to field technicians Clayton Syfchuck, Mike Suitor, and Lorraine Wilkinson for field assistance; and to Dr. Rich Revel, Dr. Brad Hawkes, and Dr. Cormack Gates for their guidance and scientific advice.

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18. Descriptions of field trips

Striking the balance: Managing for endangered plant communities, increased fuel loading, and nearby expensive real estate at Kikomun Provincial Park

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BC Ministry of Environment staff discussed the challenges associated with operating in a Provincial Protected Area and describe the multi-agency involvement process used at Kikomun Creek Provincial Park. Themes were:

- How BC Parks has incorporated its recreational mandate with its conservation and ecological restoration programs, in a grassland environment.
- Examples of fuel reduction treatments that included a range from full scale tree removal to slashing and burning
- Balancing grassland dependent wildlife and plant communities with the mandates of the various agencies that manage Crown lands

City of Kimberley's fuel treatments

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There were three stops in the Kimberley area. Participants viewed fuel treatments at various stages of completion, including: mechanical harvesting; hand treatments (cut pile and burn); chipping; hog fuel grinding for co-generation; and prescribed fire.

- Site #1 Levirs Ave
- Site #2 Kimberley Campground
- Site #3 Gerry Sorensen Way.

The following agencies are involved in the process of conducting these Kimberley fuel treatments: Kimberley Fire Department; Teck-Cominco; Tembec Industries; Resorts of the Canadian Rockies; BC Ministry of Forests and Range (Protection Program); R.W. Gray Consulting Ltd.; Kimberley Nordic Club; Kimberley Nature Park Society; and Wildsight.

Funding sources for these treatments are: the Union of BC Municipalities; Natural Resources Canada; the Community Development Fund (Job Opportunities Program); and an in-kind contribution from the City of Kimberley.

Posters and Displays

1. Fuel management prescription example and guide

Mike Dittaro, BC Ministry of Forests and Range, Vanderhoof BC
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Mike's poster was based on information available at:
http://ground.hpr.for.gov.bc.ca/forestertoolkit.htm

2. Forest Fuel Management Working Group

Al Gerow, First Nations Forestry Council and Blaine Wiggins, First Nations' Emergency Services Society

This poster complimented the presentation given by Al Gerow and Blaine Wiggins.

3. Proposed changes to the Open Burning Smoke Control Regulation

Paul Willis, BC Ministry of Environment
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Garry Bell, BC Ministry of Environment
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This poster complimented the presentation by Rebecca Freedman.

4. Methods and protocols for monitoring of fuel Abatement treatments in the Yukon

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Introduction

American and Canadian fire management agencies have fully embraced the use of fuel treatments to lower fire risk near and within communities. In the United States (US), research has examined the effectiveness of fuel treatments through quantification of pre- and post-fuel loads, incorporation of fuels data into US fire behaviour models, and documentation of fire severity within fuel treatments after wildfires. In Canada, the Province of Alberta is the only jurisdiction to date that has developed a monitoring protocol to monitor prescribed burns and to document pre- and post-conditions in fuel treatments (Cordy Tymstra, Alberta Sustainable Resource Development, pers. comm., October 2008; Alexander, 2006.).

Although fuel load sampling methods have existed for many years, there has been a lack of progress on developing a standardized monitoring protocol that is comprehensive and describes sampling methodology, calculates stand and fuel attributes, and links these to a fire behaviour prediction model. In addition there is no stand-level fire behaviour prediction model to test treatment effectiveness in terms of crown fire initiation and spread. There is also an increased need for monitoring and improving our understanding of the ecological impact of fuel treatments on biodiversity (Westhaver *et al*. 2007).

Based on these needs, a prototype monitoring protocol for fuel treatments in white spruce (*Picea glauca*) forests in the southwest Yukon was developed. Called the Fuel Treatment Prescription Compliance and Effectiveness Monitoring Protocol, this protocol is part of a more complete manual, the *Yukon Forestry Monitoring Program: Field Manual and Monitoring Protocols* (Ogden 2008) that is being used to document the ecological impacts of forest harvesting and effectiveness of management activities in reaching desired outcomes.

Purpose

These methods and protocols were developed for the spruce-beetle-killed forests of the southwest Yukon to standardize methodology for collecting field data in fuel treatments. The purpose of this monitoring protocol is twofold:

1. *Prescription compliance monitoring*: to compare post-treatment characteristics to what was prescribed
2. *Effectiveness monitoring*: to assess the effectiveness of the post-treatment characteristics of a stand in terms of mitigating or abating fire risk

Methods

This protocol involves the installation of paired monitoring plots as a means of comparing untreated versus treated areas over time. Ideally, in areas that are scheduled to be treated, plots are installed pre-treatment and measurements are made both pre- and post-treatment.

Prescription and compliance

The protocol outlines methods for gathering field data to assess the compliance of the treatment to prescription objectives for overstorey and understorey stand characteristics, and stand-level biodiversity and aesthetic attributes.

Effectiveness monitoring

The monitoring protocol includes detailed field methods to characterize tree crown and surface fuel loads, crown characteristics (e.g., inter-crown spacing, vertical continuity, and base height); fire hazard and spot fire potential (per Garbutt *et al.* 2007). Data is also collected to calculate canopy bulk density. Canopy bulk density is measured by determining the crown fuel load of individual trees within the plot and then determining how this load is represented as a volume of the crown canopy on a per hectare basis (Cruz *et al.* 2003). To assess treatment effectiveness, fire behaviour should also be modeled for pre- and post-treatment stand conditions. The Crown Fire Initiation and Spread Model (Alexander *et al.* 2006) is being explored to determine its applicability in this context.

A streamlined version of the protocol was also developed. This "lite" protocol was designed to gather essential information to aid both with the development of fuel treatment prescriptions and with monitoring the effectiveness of the treatment.

Application of methods

Forest researchers in the Yukon are applying the methodology described here to a study that is currently underway in fuel abatement treatment areas in the southwest Yukon. To date only post-treatment areas have been available for testing the protocol. Stand reconstruction was needed, based on post-treatment tree stumps, to estimate pre-treatment stand conditions. Pre-treatment stand conditions may be inferred by reconstructing stands (e.g., from stumps within the treated stand, or from nearby similar stands).

Conclusions

These protocols are a first approximation of methods for monitoring prescription compliance and effectiveness of fuel abatement treatments in the southwest Yukon. While the protocol was developed for use in the southwest Yukon, only minor modifications to tree fuels assessment methods are needed before these protocols could be applied elsewhere. This protocol is being applied as part of a regional adaptive management program in the southwest Yukon. The information gathered from the use of this protocol is intended to inform the development of best management practices for fuel abatement programs.

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5. Wildfire GIS and mapping support

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The website for GeoBC is: http://aardvark.gov.bc.ca/apps/gga/

6. The Nature Conservancy of Canada’s ecosystem restoration program at the wildland/urban interface

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The Nature Conservancy of Canada (NCC) is a national charity dedicated to the long-term stewardship and conservation of ecologically significant land, through private action. NCC is a non-profit, non-advocacy group that takes a business-like approach to land conservation.

NCC has undertaken ecosystem restoration on two properties in the vicinity of Canal Flats, BC. These properties are located in the Natural Disturbance Type 4, which is characterized by a frequent, stand-maintaining fire regime. Historically, this disturbance type would have supported an open forest structure with a vigorous understorey of forbs, grasses, and shrubs. In addition to improving winter range for elk and mule deer, habitat for the red-listed American badger has also been enhanced. Further, recreating an open forest stand structure has reduced the risk of catastrophic wildfire affecting both neighbours and occupants.

Griffiths Covenant

- NCC holds a Conservation Covenant on this property
- Property size 113 ha
- Property is occupied by owner with associated house and outbuildings
- 37.1 ha were treated to a tree density of 100 and 140 layer 1 stems/ha (mechanical logging with faller buncher and grapple skidder; sawlogs and pulp wood removed)

Kootenay River Ranch

- NCC owns this property in fee simple
- Property size 1340 ha
- Property is unoccupied, but has neighbours to the north, east, and west
- 139 ha were treated to a target density of 150 stems/ha (hand slashing with hand and machine piling; sawlogs and small products removed)

Summary of Comments from Conference Evaluation Forms

There were **145** people at the conference and **47** evaluation forms were returned. Not all forms had a response for each question.

1. How well did the conference meet your expectations?

19 people recorded that their expectations were fully met (40% of responders).
25 people recorded that their expectations were mostly met (53%).
1 person recorded that expectations were mostly met/met only a few (2%).
2 people recorded that only a few of their expectations were met (4%).

2. Do you have comments about any of the presentations?

General, positive comments: 40
Additional specific comments:

- Wants more visuals, less text
- Very committed folks in a difficult political and economic environment
- Good speaker management and everything was on time (4 comments)
- Enjoyed diversity of topics—from wildlife to funding
- Enjoyed the way ecological and social topics were mixed up and had common threads
- Bigger screen next time
- Operational information will be passed on
- Follow-up symposium will be important
- Some overlap in talks (2 comments)
- Glad to see viewpoints from a variety of perspectives
- Wanted more information on the effectiveness and impacts of fuel mitigation in urban forests.
- Too many Banff presentations, which do not represent reality in most of BC
- Too many park presentations; more on what communities are doing
- Wanted fewer presentations and more time for each; maybe a panel discussion
- Liked the half-hour presentations; easy to concentrate and stay focused
- Provincial government was over-represented
- Communications talk could be turned into a full day workshop
- Too much focus on “burning is good;” Klenner’s presentation added balance
- Very timely on how imposing our “will” on ecosystems can have drastic effects if we don’t consider ecosystem function
- Almost all missed the important topic of air quality
- Blend of speakers from many disciplines provided good overview

3. The papers at this conference were assembled from a "call for papers" and we know there were some topics that were missed. In a few years we will be holding a sequel to this conference. Which topics would you like to hear about at our next conference? Can you suggest someone we can approach to cover these topics when we send out the call for papers?

- What are costs associated with fuel management and treatments, prescribed burns (4 comments)
- Risk/consequences paper for First Nations
- More talks on how communities are addressing WUI issues (2 comments)
- Many of us are involved in WUI fires issues OR ecological restoration, not both, these could be addressed separately.
- Wants ecosystem restoration conference similar to CMI's event in 2007
- How can ecosystem restoration be accomplished along with WUI issues? (3 comments)
- Would be interested to explore more about the public perception of prescribed burning and WUI fires management.
- More examples of integrated landscape approaches for WUI/wildland gradients
- Forest microclimates as a result of fuel management
- Fuel treatments on private lands (3 comments)
- Follow-up on effectiveness of fuel treatments (2 comments)
- Fire effects and invasive plants (2 comments)
- Wants actual examples of fuel reduction treatments
- Fire management outside of WUI
- Natural range of variation and fire regime analysis—Marie-Pierre Rougeau from Banff
- Mapping of wildfires and use of geographic tools
- Sources of funding for First Nations
- Fire protection in and near communities requires and integrated approach: education, municipal policy, building codes, fuel treatment, etc. It's a challenge for communities to grasp it all. Good to structure talks so these issues are addressed in sections.
- Fire mapping, and emergency response and support
- GEOBC could offer presentation on how GIS is being used as a technology
- Thoughts on building community capacity to implement CWPP
- More concrete examples of all aspects of WUI fire management (2 comments)
- More speakers that address the side effects, e.g., on soil, habitat, wildlife, watersheds
- How to build in Best Management Practices for smoke management in burn plans
- City of Kamloops—what are they doing?
- Use of grazing for fuel management
- Fire behaviour and fuel treatments, Dave Schroeder with FERIC
- Tom Lacey, District of Logan Lake

- Tom Lanoville
- fire disturbance and fire regimes
- disposal options, bioenergy?

4. We'd like to know if what you learned at this conference will make a difference to you in the future. Can you suggest a few things that you will do differently when you are back at your office?

- In the future I will communicate more with stakeholders, other agencies, general public (5 comments)
- I need to do more consultation and professional reliance (2 comments)
- Will think more about getting productive participation from stakeholders (2 comments)
- Will organize a prescribed burning group at my band (Ulkatcho) and make up some presentations on prescribed burns
- Will follow-up on resources suggested by speakers (fire video, communications resources)
- Useful contacts and references for the future, networking appreciated (7 comments)
- Learned lots that will be useful in the future (3 comments)
- Will work harder with our neighbours
- Always consider as many parties as possible when considering fuel management projects
- Will widen scope of treatments available
- I will consider more factors
- I didn't learn new things, but was reminded of many things
- Good to see how others are handling their challenges
- Helpful for understanding what others are doing in their field
- I need to be better prepared and supportive in the event of a WUI fire
- I have a much better understanding of what BC Parks is doing and why
- Useful to know more about funding resources
- Know lots more about smoke
- Will keep an eye on Open Burning Smoke Regulation requirements
- I am applying for a UBCM grant this fall and this conference helped me think about considerations for carrying out the project
- Learned about CWPP program
- Fuel management as private landowner's responsibility will be a key consideration when evaluating proposed land developments
- Better understanding of available research
- Heightened awareness of how vegetation and trees should be evaluated
- Importance of incorporating biodiversity into my fuel treatments
- Burn decisions and strategies are less black and white than I thought
- Thanks to First Nations, learned about the idea of training "extension" workers to implement CWPP

- Better understanding and appreciation of the business side will result in developing long-term plans for GIS support. In particular, analysis, modelling, and tools and applications as related to GIS.
- Discussion about habitat and fuel management will help me
- Pengelly's talk gave insights into problem bears in treatment areas—we may be subject to this, too, and now I have someone to call for advice
- Will incorporate wildlife and biodiversity considerations into WUI treatments
- Will research Model Forest website to see how applicable their ecological guidelines are to BC

5. Do you have any other comments about the conference? Any comments on the venue, food, registration process, etc.?

- Good conference (19 comments)
- Wants more handouts to take home
- Wants dinner to keep people together before evening speaker (3 comments)
- Wants transportation arranged to and from airport
- Wants carpooling organized to travel to conference
- Wants to be seated at tables for ease of note-taking (3 comments)
- Various and sometimes contradictory comments about food service
- Wanted a "mixer," would help those from far away who didn't know others
- Wants trade show
- Wants details about speaker history

6. The Columbia Mountains Institute is always looking for suggestions for courses and workshops. Our niche is providing continuing education for ecologists, resource managers, foresters, biologists, and educators. We offer skill upgrading, and workshops that address current ecological issues. Do you have suggestions for events or courses you'd like to see us organize?

- Would like to see non-timber forest products course
- What are the legislative requirements; where do federal and provincial laws apply; how do COSEWIC, red and blue lists, and BC conservation Data Centre all fit together
- Multidisciplinary exploration for adaptation to climate change as it relates to western Canadian resource management
- How to involve stakeholders and private landowners, refining the processes that creates involvement and solutions, in the WUI (2 comments)
- Noxious weed conference
- Ecological restoration
- How to assist private landowners for WUI management?
- WUI fire treatment workshop, with a field component, to demonstrate good and bad outcomes. Target would be monitoring plan design elements, monitoring could be carried out by communities and/or professionals.

- Wants more courses on mapping, GPS, GIS, etc. as these are tools that can be used on many levels.
- Fuel management 101, 201, 301, 401
- Community and regional adaptations, to climate change, and to more sustainable living…getting better skills and knowledge about renewable energy, dealing with food crisis, watershed planning and protection, community forestry
- Workshop on fuel management prescription writers, on what needs to be covered in a plan, where to obtain relevant background data, examples of completed prescriptions, etc.
- Climate change—can be specific to ecosystem changes or wildlife habitats
- Follow-up on land use plans around the province—"10 to 20 years later, did it work?"