The impact of Mountain Pine Beetle on Fire Behaviour - A case study of the Mitchell Ridge Prescribed Burn, Kootenay National Park, Canada.

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Overview

- Introduce Mitchell Ridge Prescribed Burn
- Outline Research
- Describe Prescribed Burn
- Review Results
- Observations

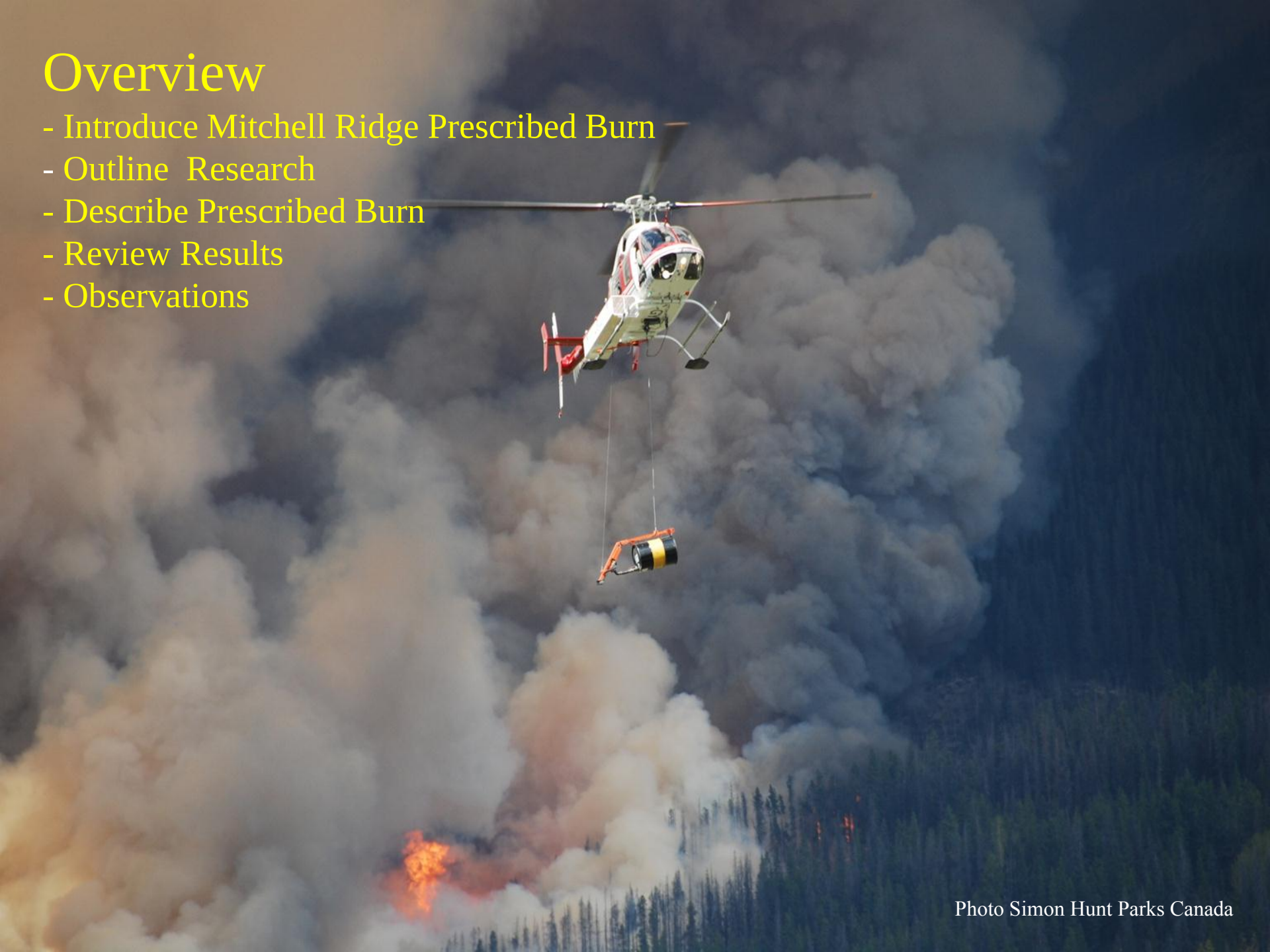
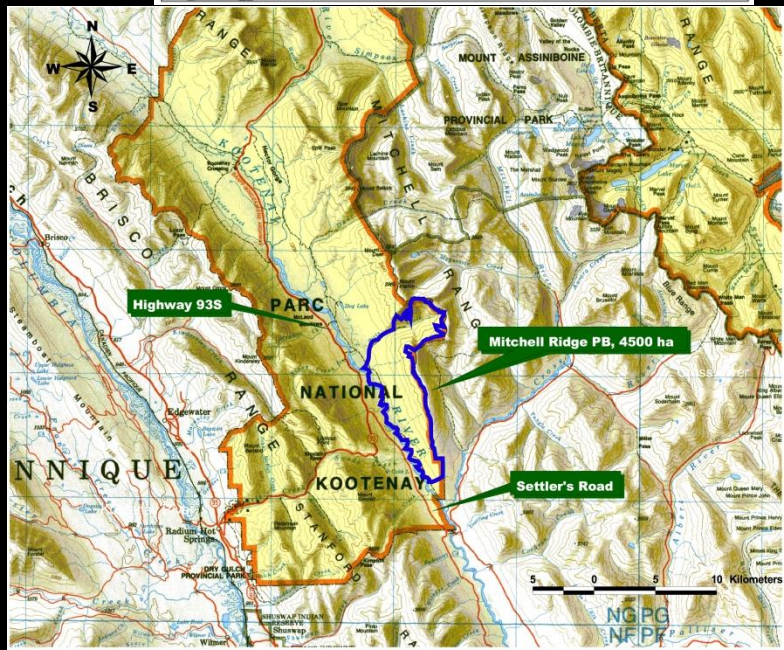


Photo Simon Hunt Parks Canada

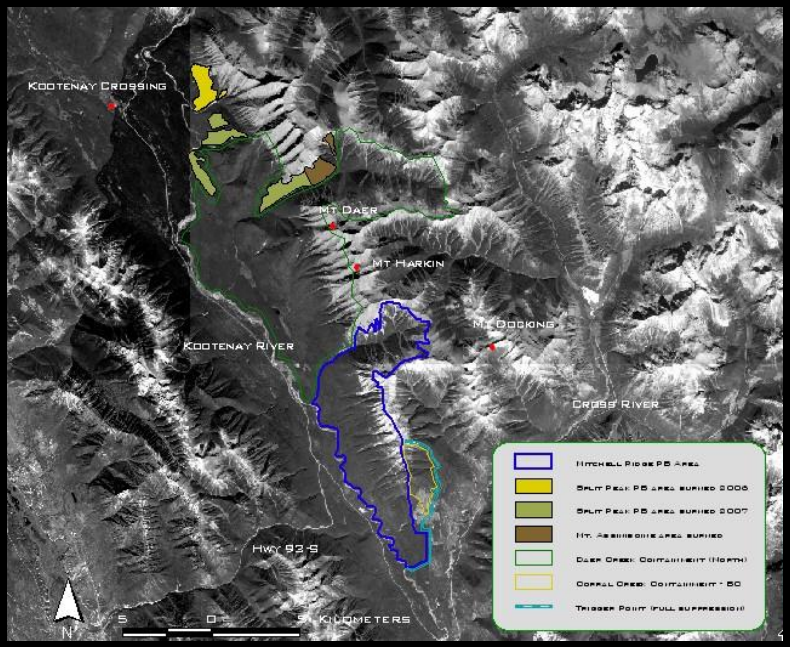
Mitchell Ridge Prescribed Burn

- Located in Kootenay National Park in SE British Columbia
- Prescribed Burn part of ongoing Parks Canada Agency program aimed at restoring historic fire regime
- Planned 4500 hectare unit to meet a number of objectives
  - Contribute to area burned targets
  - Reduce MPB susceptible habitat
  - Restore critical wildlife habitat



Mitchell Ridge Prescribed Burn Landscape Overview

- Burn area largely impacted by historic fire in 1917
- Closed lodgepole pine dominated forest on valley walls
- Kootenay Valley heavy fuel loading
  - MPB since mid 1980s
- Split Peak PB north end of valley fall 2006 and 2007



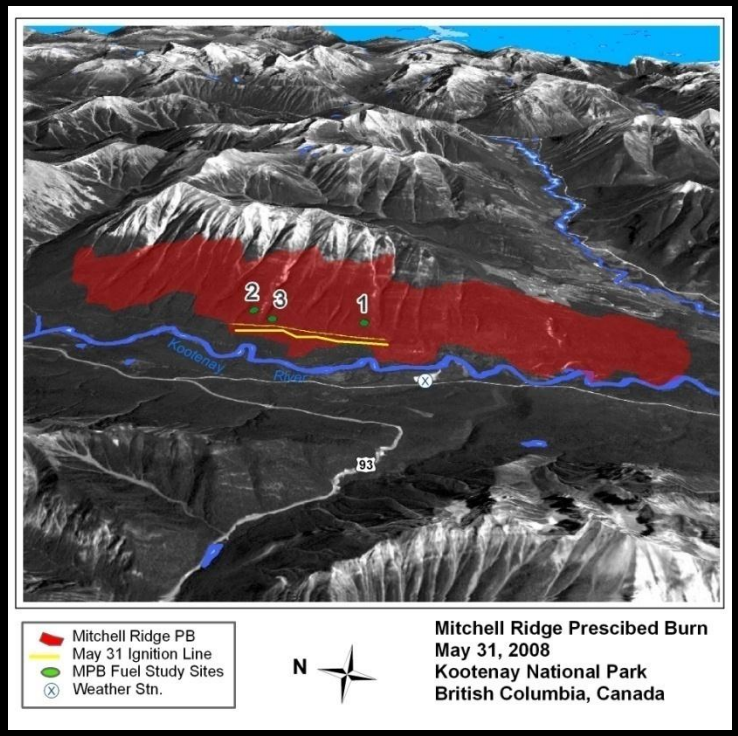
MPB Affected Fuels Monitoring

- Saw opportunity to contribute to significant questions
  - Rate Of Spread
  - Intensity
  - Crown Fire Initiation
- Conceptually built into PB plan
- Established broad methodology and began to gather data one year out

KNP Split Peak PB 09/16 2007
Photo Trevor Jones

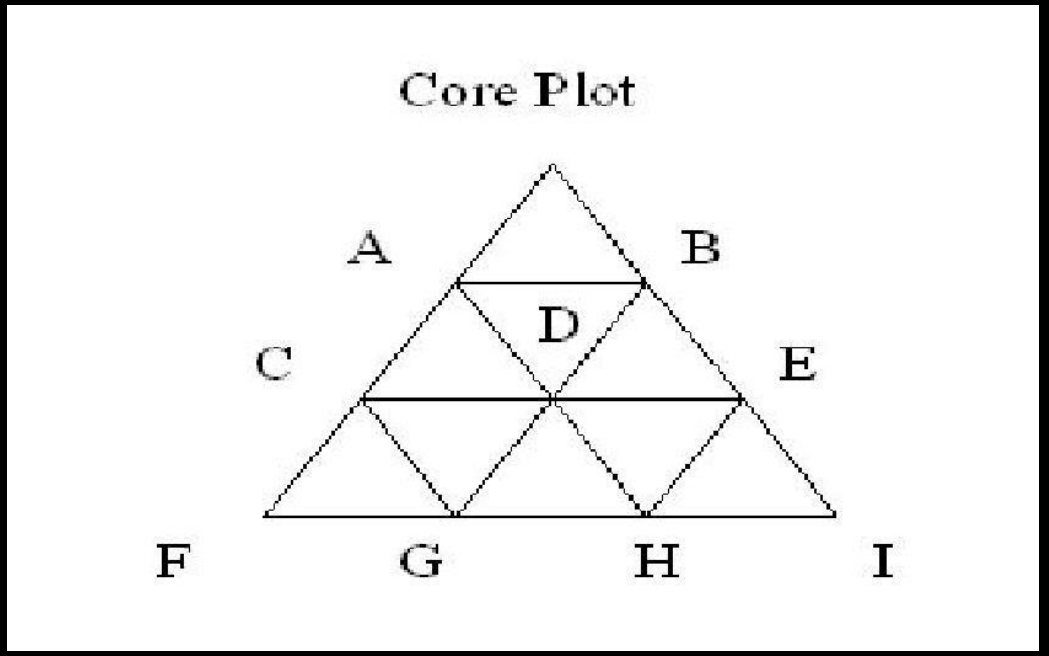
Research Design

- Established three plots:
  - 1- MPB affected 1980s
  - 2 – MPB currently affected
  - 3 – unaffected by MPB
- In a line across slope
- Designed for a single line ignition



Research Design – Plot Layout

- Study Site = 1 core station and 9 substations on a 100 metre grid
- At all stations
  - Thermocouple
  - Duff pins
  - Photo plots
- At core station
  - Large Fuel Sampling
  - In-Stand Cameras
  - Stand structure plots



Methods – All Stations

- Established Rate of Spread and Temperature Flux
- Utilized HOBO ™ and Wren Greenline ™ thermocouples and data loggers
- ROS calculated following Simard 1984 utilizing100 metre grid

Methods – Core Stations

- Established Large Fuel Consumption following Brown 1982
- Byrams equation I = Hrw to calculate Intensity
  - H = heat yield
  - r = ROS
  - w = large fuel consumption
- Established on-site fire behaviour observations utilizing In-stand Cameras

Burn Day Conditions

- 1300 MDST weather
  - Temperature 20.6° Celsius
  - Relative Humidity 27%
  - Windspeed 10.2 km/h
  - 24 hour Precipitation 0.0 mm
- CFFDRS
  - Fine Fuel Moisture Code 91.9
  - Duff Moisture Code 42.1
  - Drought Code 106
  - Build Up Index 42.3

Main Unit Ignition Saturday May 31

- Main Unit Ignition approximately 1330 MDST
- Ignition completed by two helitorch runs approximately 500 meters below plots

Photos Darren Quinn Parks Canada

Observed fire behaviour

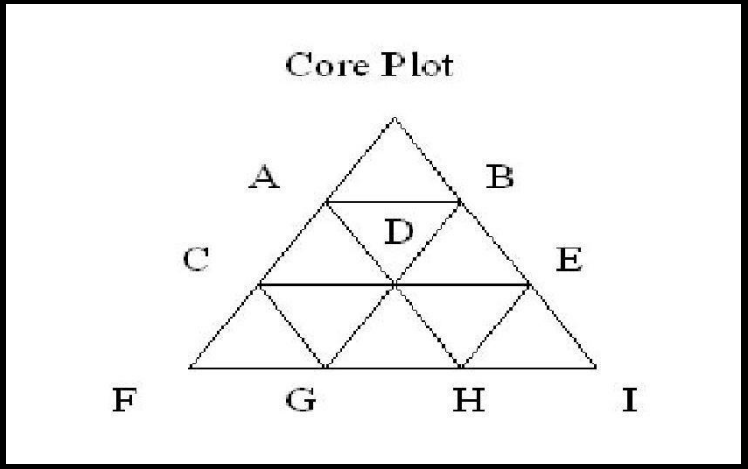
Initial Observations

- All three core plots consumed by crown fire
- June 1st Collected
  - In-stand cameras
  - Thermocouples
  - Remeasured Duff pins and large fuel consumption

Results – Rate of Spread

- ROS calculations challenged at all sites
- Combination of observations and thermocouple data provide best picture
- ROS for upper triangle utilized in Intensity calculations

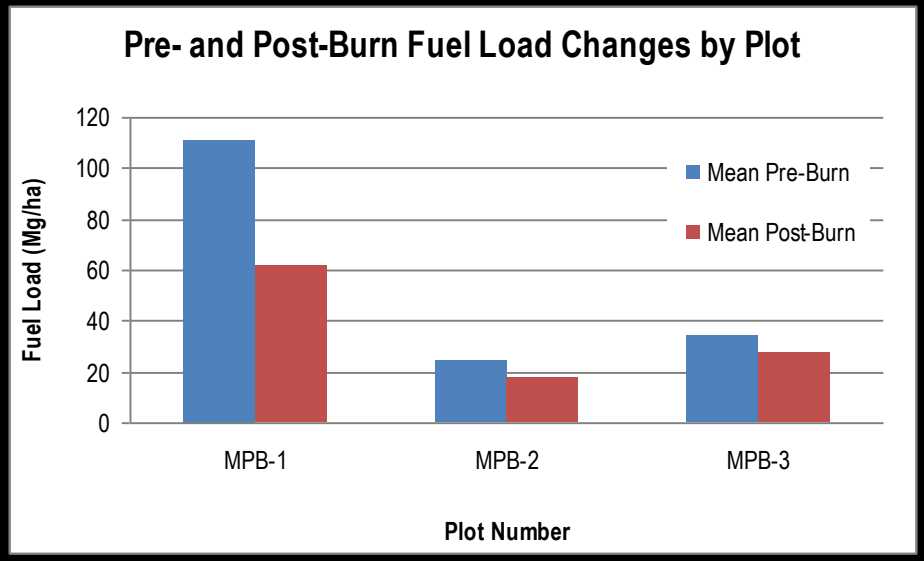
Plot	Location	Rate of Spread m/min
MPB1	A-Cr-B	27.6
MPB1	C-A-D	37.1
MPB1	A-D-B	31.8
MPB1	G-C-F	7.5
MPB1	G-C-D	6.2



Results – Temperature Flux

Station	Residence times (minutes)		
	> 60°C	> 200°C	> 500°C
Core	79.8	20.2	7.1
A	23.3	8.1	3.9
B	21.8	8	1.9
C	12.7	3.2	1.2
D	46	20.7	12
E	39.9	20.2	3.3
F	16.9	3.4	1.3
G	32.5	9.6	12

Results - Large Fuel Consumption



Site 1 - 4.93 Mg/ha large fuel consumed

Calculated Fire Intensity – Site 1

Predicted	Fire behaviour model	Fuel type	Fire type	Rate of spread ($m\ sec^{-1}$)	Fire intensity ($kW\ m^{-1}$)
Predicted	CFFBPS	C3	Crown	0.3	6553
Predicted	CFFBPS	M3	Crown	0.47	17962
Predicted	BehavePlus	SB3	Passive crown	0.36	6208
Predicted	FMAPlus	10M	Surface	0.21	3648
Observed	**-**	**-**	***Crown***	***0.46***	***40820***


1st spot fire ignition:
1401:50 hrs
Head fire:
1402:40
FPInnovations
FERIC

Observations

- MPB 20+ year fuels are a volatile fuel type
  - ROS likely linked to fuel that is carrying fire
  - Fuel bed with abundant raised fuels not functioning like forest floor fuel
  - Large volumes of large fuels = longer combustion time and severity

MPB1 Station A 360° Preburn (Above) Postburn (Below)

Summary

- Contribute observed Fire Behaviour in MPB affected fuel
  - ROS /Fuel Consumption
- Fire Behaviour in MPB affected fuel is not well represented by current fuel models
- Fire behaviour in MPB affected fuels 20+ years may be a concern
- Prescribed burns can play a role in this type of research

Photo Dave Schroeder FERIC