Effectiveness Monitoring of Fuel Treatments

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Fuel Treatment Idol?
What is an Effective Fuel Treatment (Break)

• Significantly alters fire behaviour such that fire suppression efforts can safely mitigate fire spread to values (Mooney 2010)

• How do you determine this?
How will fuel treatments be used in fire suppression strategies and what can add to their effectiveness?

- Structure and Property Retardant and Foam Application
- Monsoon Sprinklers Used for Burn Out Operations
- Sprinklers or Retardant Drop – more open canopy
- AQUA-RACK system
- Fire Storm Technologies
- Sprinkler Structure Protection
- Underburn

This house has Fire Blankets on it.
Approaches to Determine the Effectiveness (or Limitations) of Fuel Treatments – Stand* and Landscape Scales

- Experienced Judgment/Opinion (knowledge of all conditions?)
- Wildfire Case Studies (many in US; a few in Canada)
- Mathematical Model Simulations (e.g. CFIS; Nexus; BurnP3; Farsite)*
- Outdoor Experimental Fires (e.g. NWT FERIC)
Stand Fuel Treatment Goals

- Slow Surface and Crown Fire Spread Rate and Lower Fire Intensity
- Change Fire Type from Active Crown Fire to Passive or Surface Fire
- Lower ignition probability – fire starts and growth rate
- Reduce Above and Below Ground Fire Severity
Changes in Ignition Probability in Thinned Lodgepole Pine Stands
FERIC David Schroeder/MOFR/CFS

Control
Ignitions 9%

<1cm fuel load 3.7 t/ha

Thinned - Slash Left
Ignitions 54%

<1cm fuel load 10.6 t/ha

Thinned - Slash Removed
Ignitions 15%

<1cm fuel load 6.0 t/ha

Photo Credit: FERIC
Fuel Treatment Objectives to Meet Goals and Attributes to Monitor

- significant reduction of surface fuel load (surface fine and coarse woody fuel load)
- increase the height to live crown (crown base height)
- decrease canopy bulk densities by increasing overstory inter-crown spacing and reducing understory trees – ladder fuels (CBD by height)
- retain trees with lower crown fire susceptibility (e.g. aspen) or are fire-resistant (e.g. thick bark species) if available (species composition)
How do we evaluate our plans / treatment areas for success?

- Prescription compliance
  To assess whether or not fuel treatment work carried out in the past was consistent with the fuel treatment prescriptions

- Effectiveness monitoring *
  To assess whether or not the treatments were effective in reducing the risk of a crown fire developing in these stands.
Fuel Treatment Monitoring Protocol for White Spruce forests in SW Yukon

“COUNTING STICKS’ MADE FUN & EASY!
EXCEL SPREADSHEET CALCULATOR FOR CANOPY BULK DENSITY!
FREE GO-NO-GO GAUGE
Variability in Pre and Post Canopy Bulk Density for Canyon 1-3 (4)
Fine Fuel Moisture differences between thinned and un-thinned taken from Whitehead et al 2005 study
Software Can Assess Fuel Treatment Effectiveness on Crown Fire Behavior

The main outputs of CFIS are its ability to determine the:

- Likelihood of crown fire initiation or occurrence,
- Type of crown fire (active vs. passive) and its rate-of-spread, and
- Minimum spotting distance required to increase a fire’s overall forward rate-of-spread.
100-150 m
Spotting-
Most Common
Fuel Break
width 150-
200m (Mooney
2010)

Red – Yukon Canyon 1-4 | Thinned | Natural
--- | --- | ---
Density (stems/ha) (Spruce) | 500 (391) | 2340 to 5000 (1291)
Mean crown spacing (m) | 3.6 (3.5) | n.a.
LCBH (m) | 9.8 (3.0) *** | (0.80) (0.80)
CBD (kg/m$^3$) | 0.07 (0.07) | 0.16 (0.18)
Woody (kg/m$^2$) ≤7 cm | 1.52 (0.60) *** | 0.76 (0.60)

Post CBD reduced from 0.07 to 0.05 kg/m$^3$ – only passive crown fire or surface fire
Other Models?

Wildland Fire Dynamics Simulator (NIST)

FIRETEC (LANL)
Maintenance and Monitoring

• Frequency of re-assessment? 5, 10yrs?
• What to measure?
• Insects, thinning damage, disease, flammable vegetation response, windthrow
Wildland Urban Interface and Beyond: Combined Approach? Opportunities?