Effectiveness Monitoring of Fuel Treatments

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Natural Resources Canada | Ressources naturelles Canada

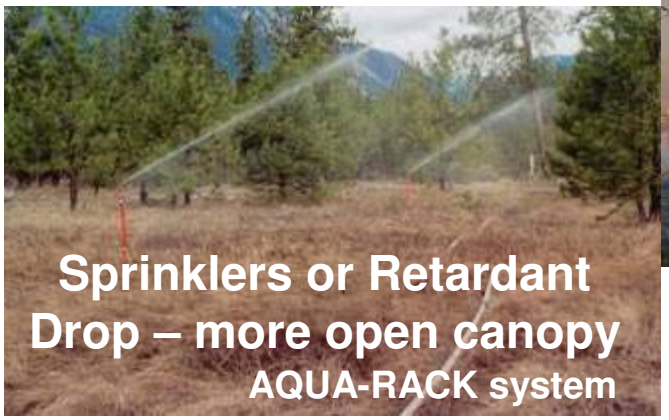
Canada

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?



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

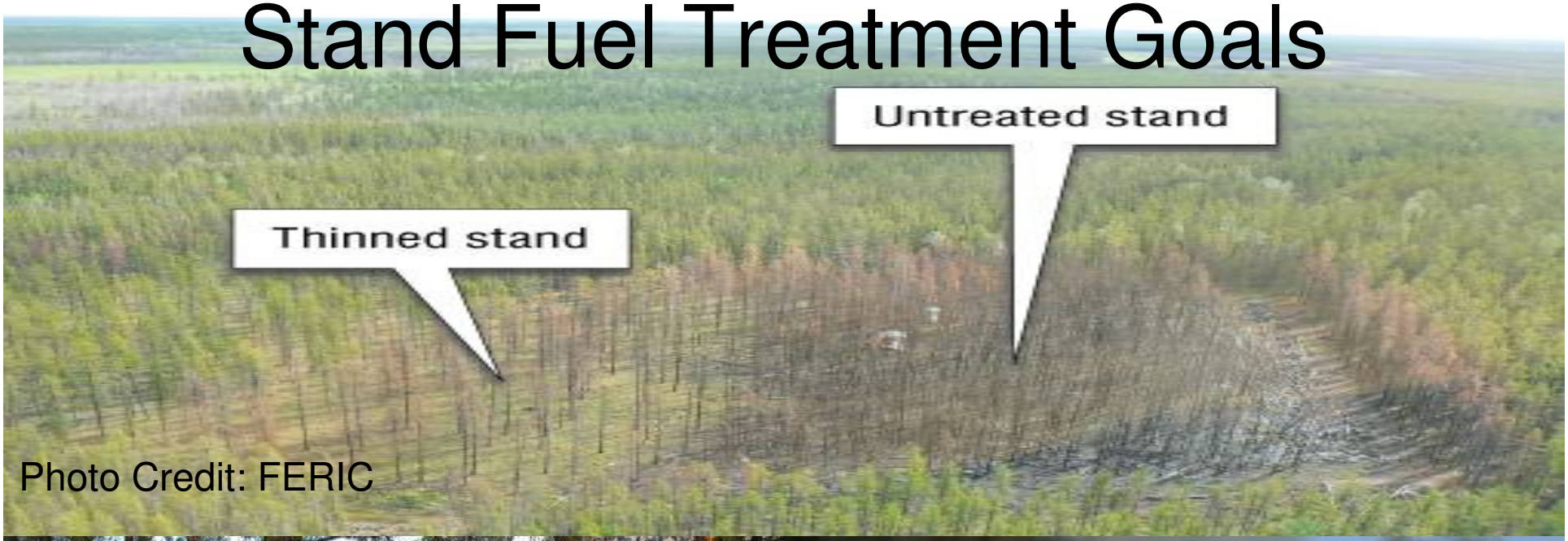


Photo Credit: FERIC

- 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

Photo Credit: FERIC

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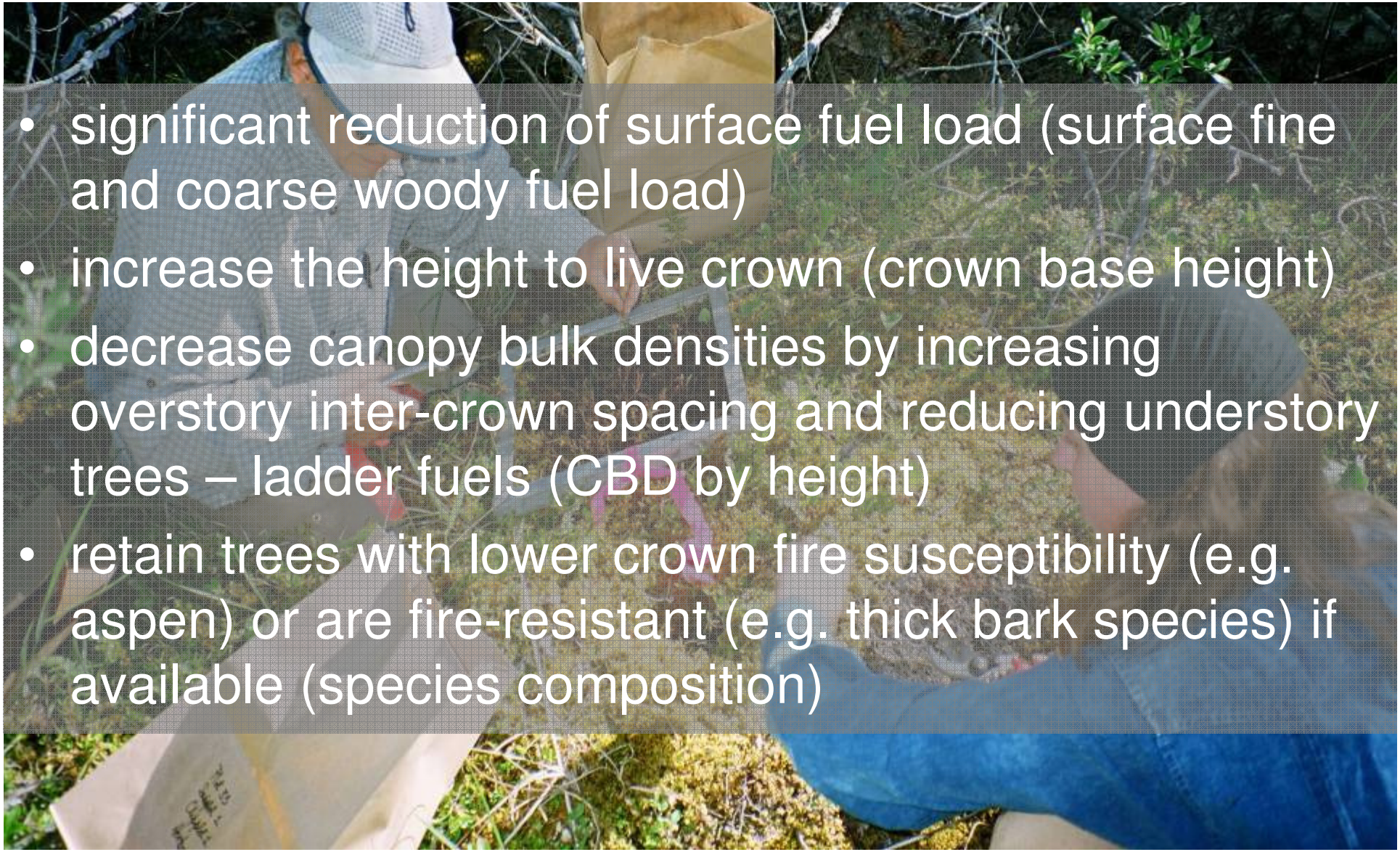
Changes in Ignition Probability in Thinned Lodgepole Pine Stands

FERIC David Schroeder/MOFR/CFS

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)

SW Yukon Fuel Treatment Pilot Program

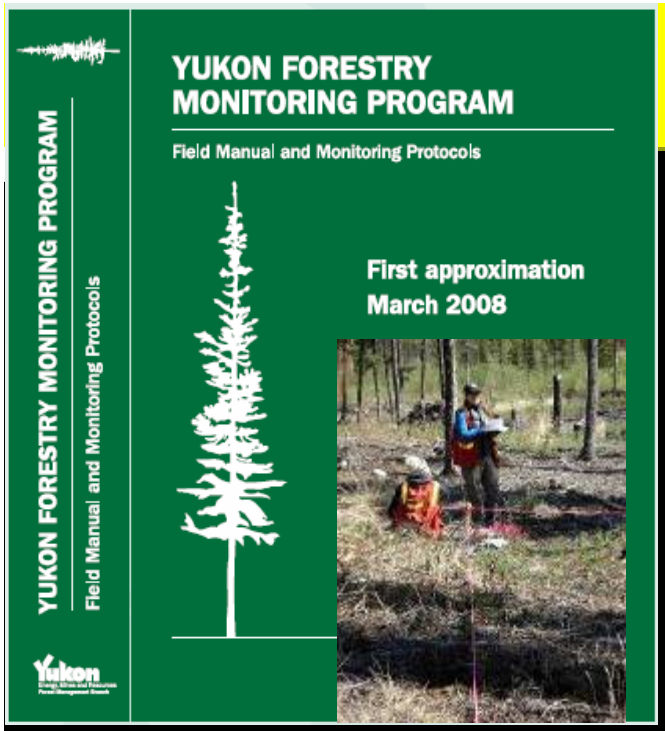
"How do we evaluate our plans / treatment areas for success?"

- 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.



2008 EDITION

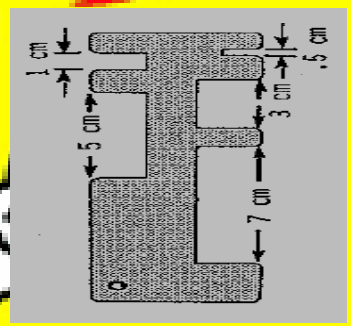
Fuel Treatment Monitoring Protocol for White Spruce forests in SW Yukon

Lite BEER

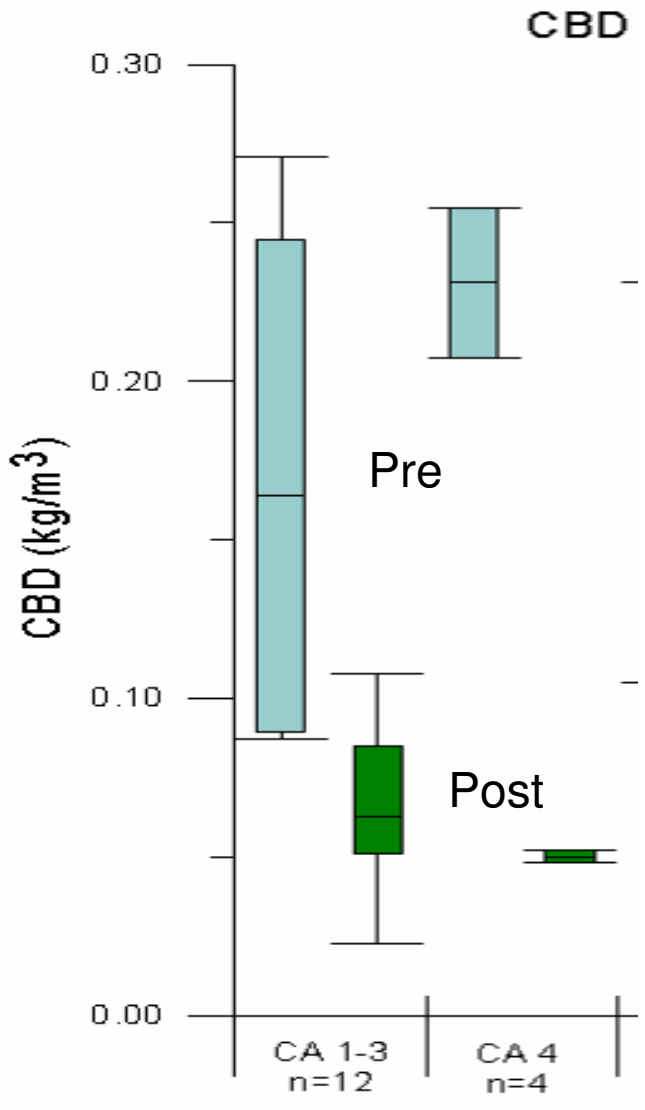
FREE GO-NO-GO GAUGE

"COUNTING STICKS' MADE FUN & EASY!

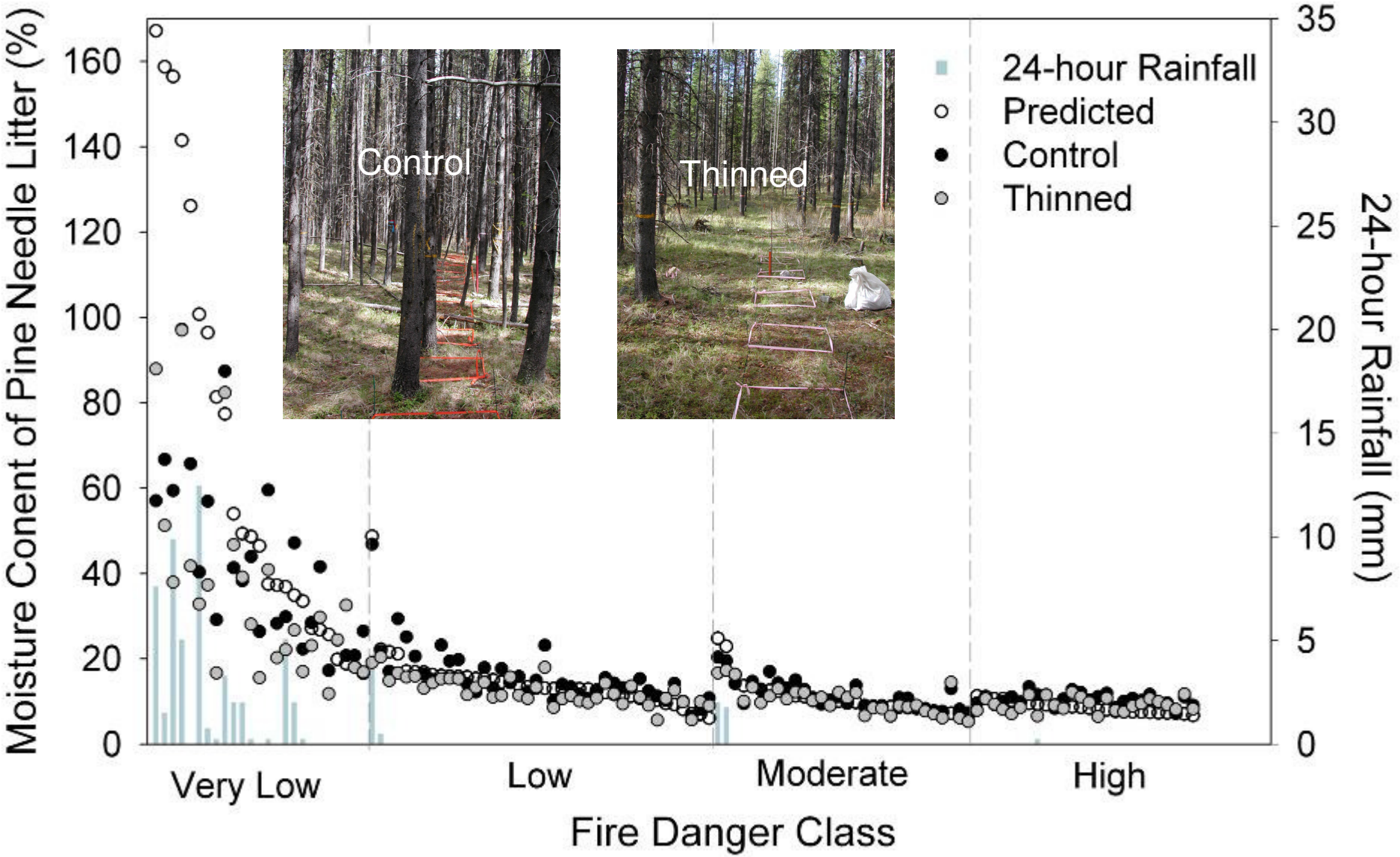
EXCEL SPREADSHEET CALCULATOR FOR CANOPY BULK DENSITY!



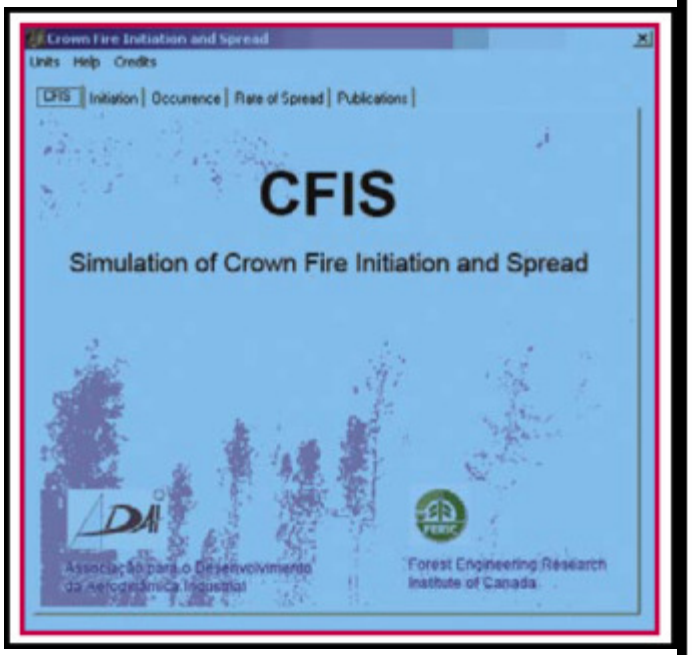
Variability in Pre and Post Canopy Bulk Density for Canyon 1-3 (4)



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

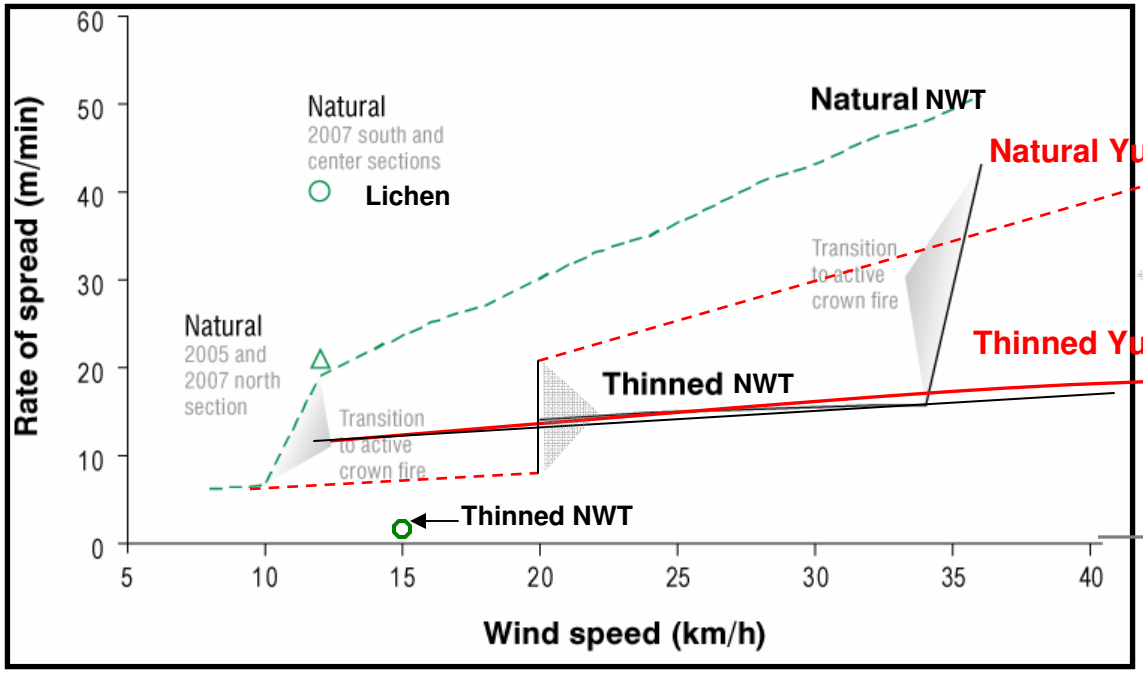


The main outputs of CFIS are its ability to determine the:

- 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.

FERIC NWT Jack Pine – FFM – 8% (Pre 11.4% Post 10%)

100-150 m Spotting- Most Common Fuel Break width 150-200m (Mooney 2010)

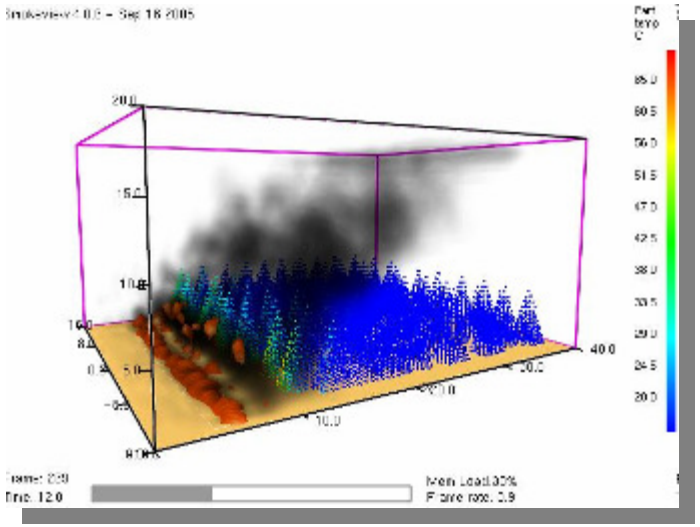


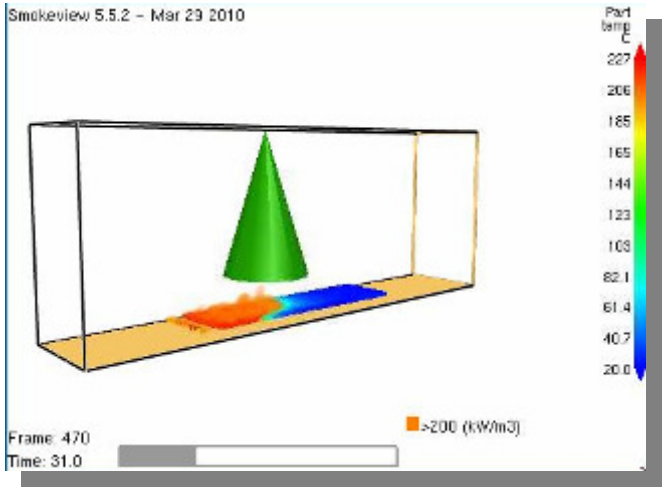
Post CBD reduced from 0.07 to 0.05 kg/m^3 – only passive crown fire or surface fire

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)	

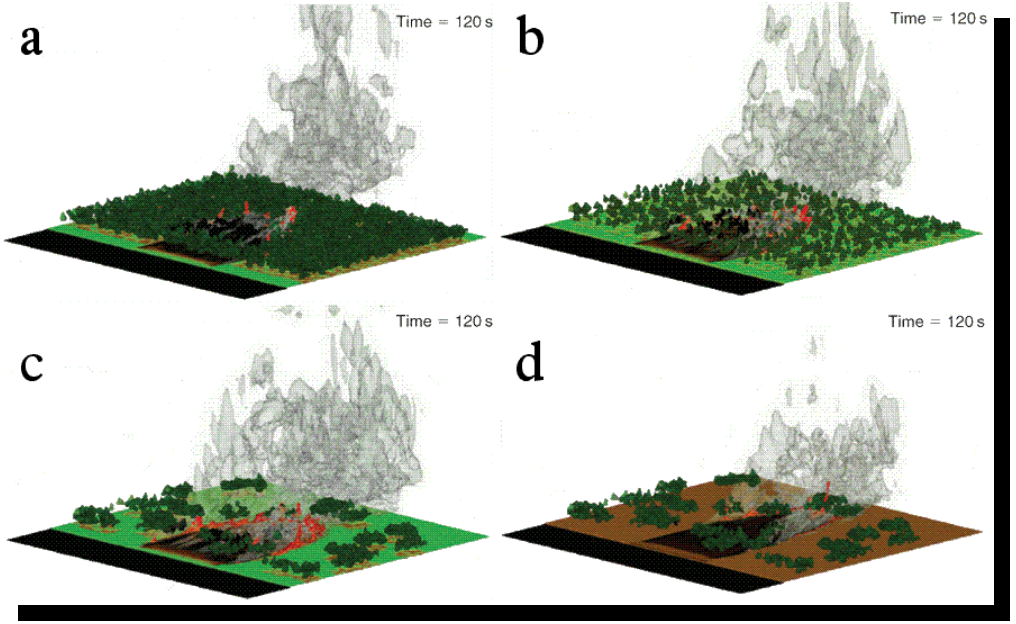
Other Models?

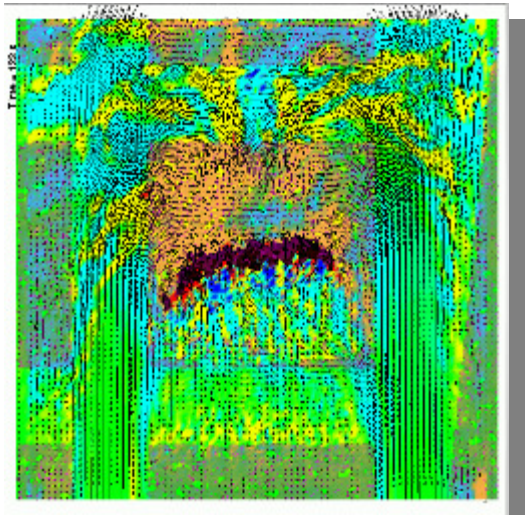
Wildland Fire Dynamics Simulator (NIST)



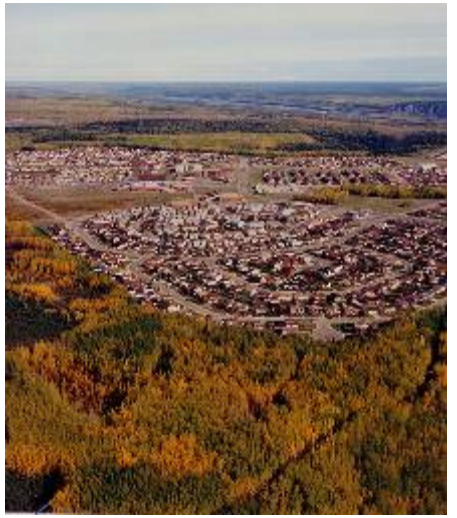


FIRETEC (LANL)





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?