

# Fire Behaviour in MPB-Affected Stands, BC: Validation and State of Knowledge

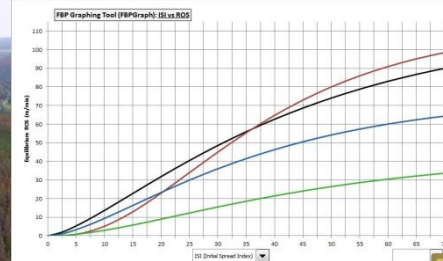
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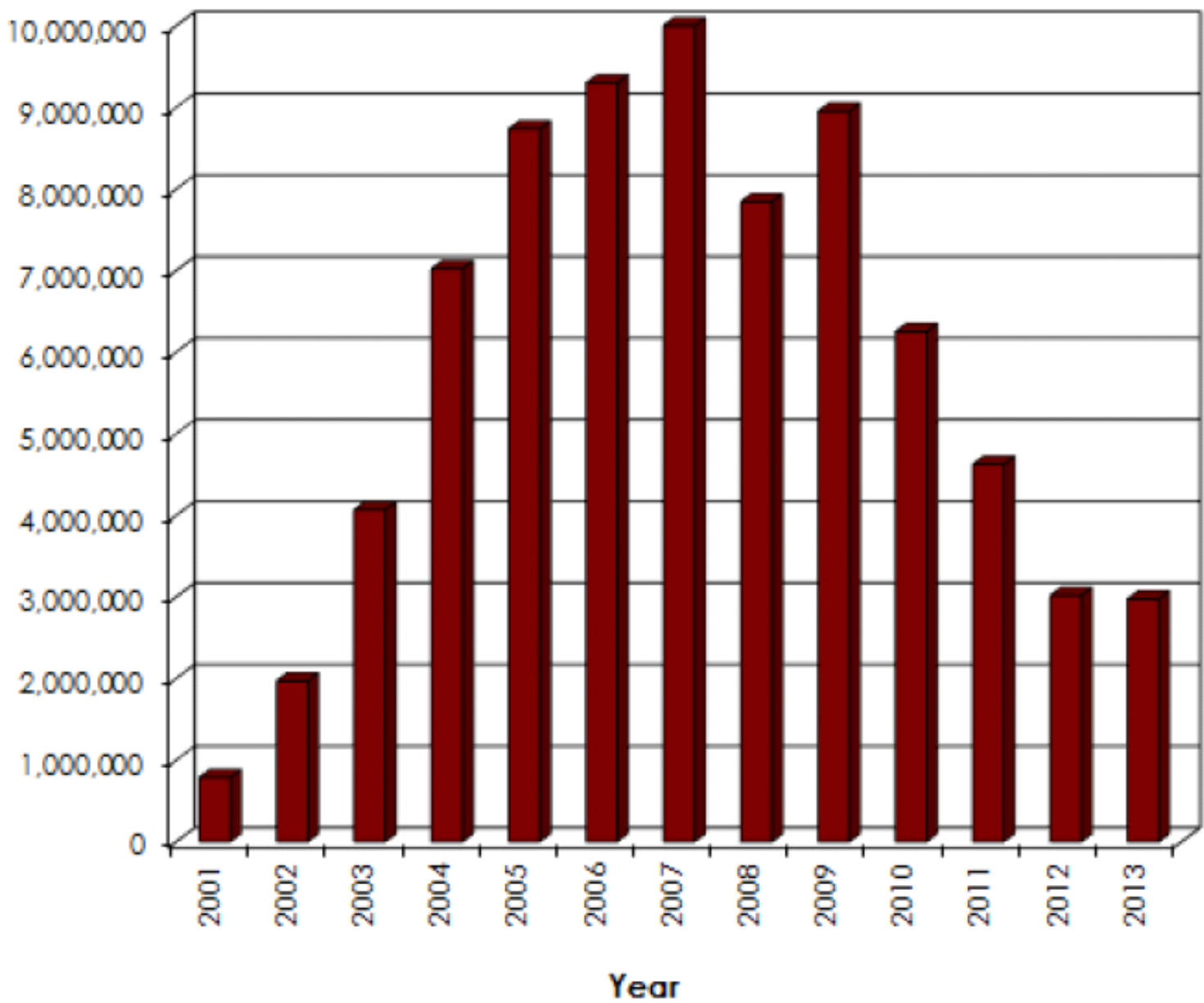
## Fire Behaviour in MPB-Affected Stands – State of Knowledge

### ➤ Problem:

- BC interior plateau dominated by lodgepole pine
- Massive outbreak of MPB, since late 1990s
- Many challenges, knowledge gaps → fire is just one issue (but a big one!)
  - MPB-affected stands poor match/mismatch with fire behaviour fuel types
  - Rapidly changing structure (green-yellow-red-grey)

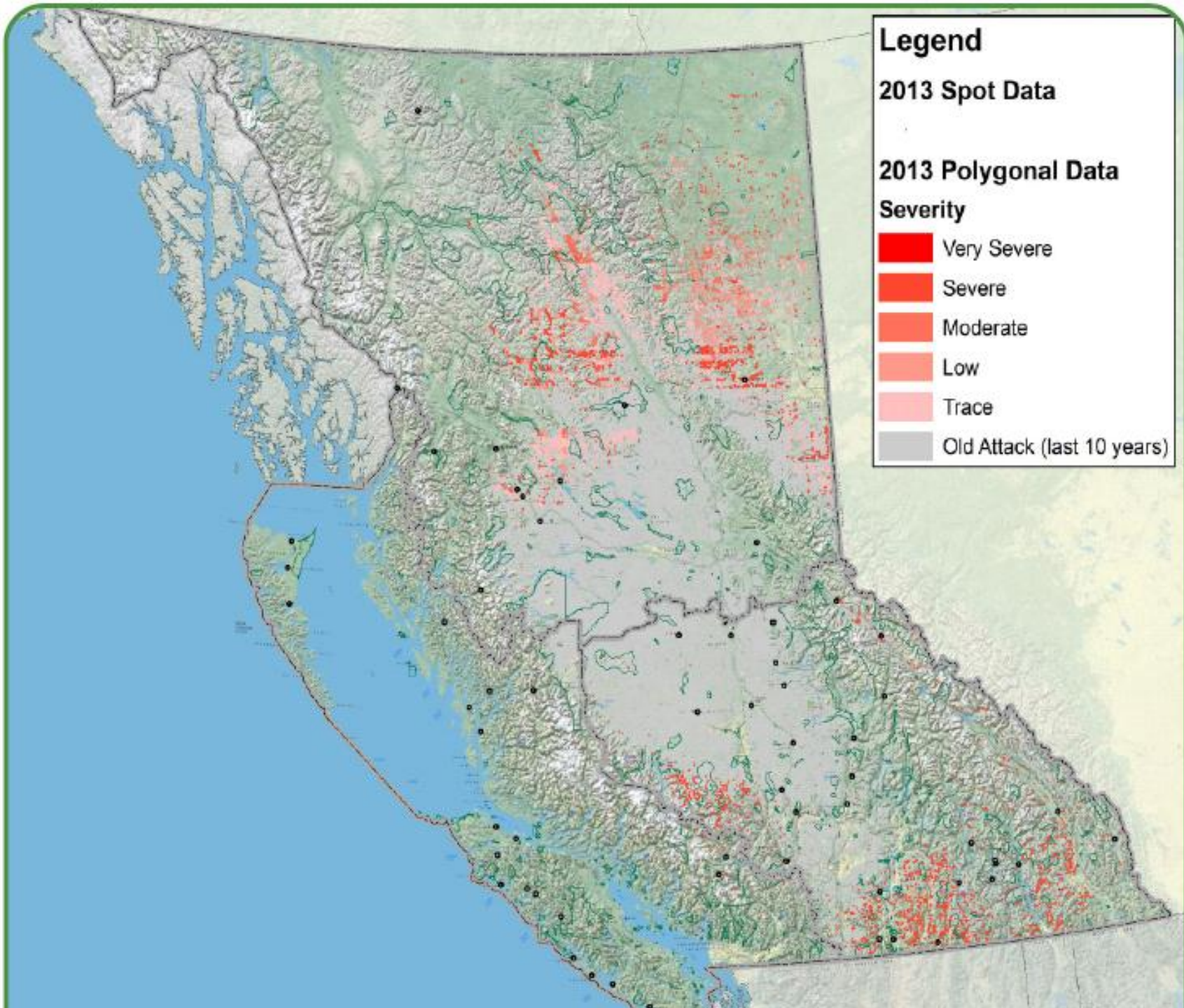


Hectares Infested



Source:  
Westfall and  
Ebata 2013

Figure 3. Hectares infested (all severity classes) by mountain pine beetle from 2001 – 2013 in British Columbia.









## Legend

### 2013 Spot Data

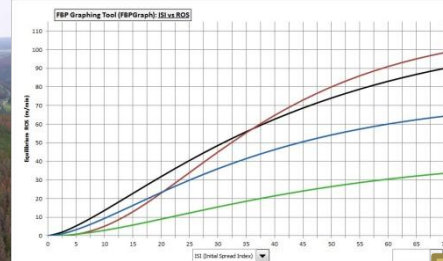
### 2013 Polygonal Data

#### Severity

-  Very Severe
-  Severe
-  Moderate
-  Low
-  Trace
-  Old Attack (last 10 years)

**~2003 – 2008: peak red-  
attack phase**



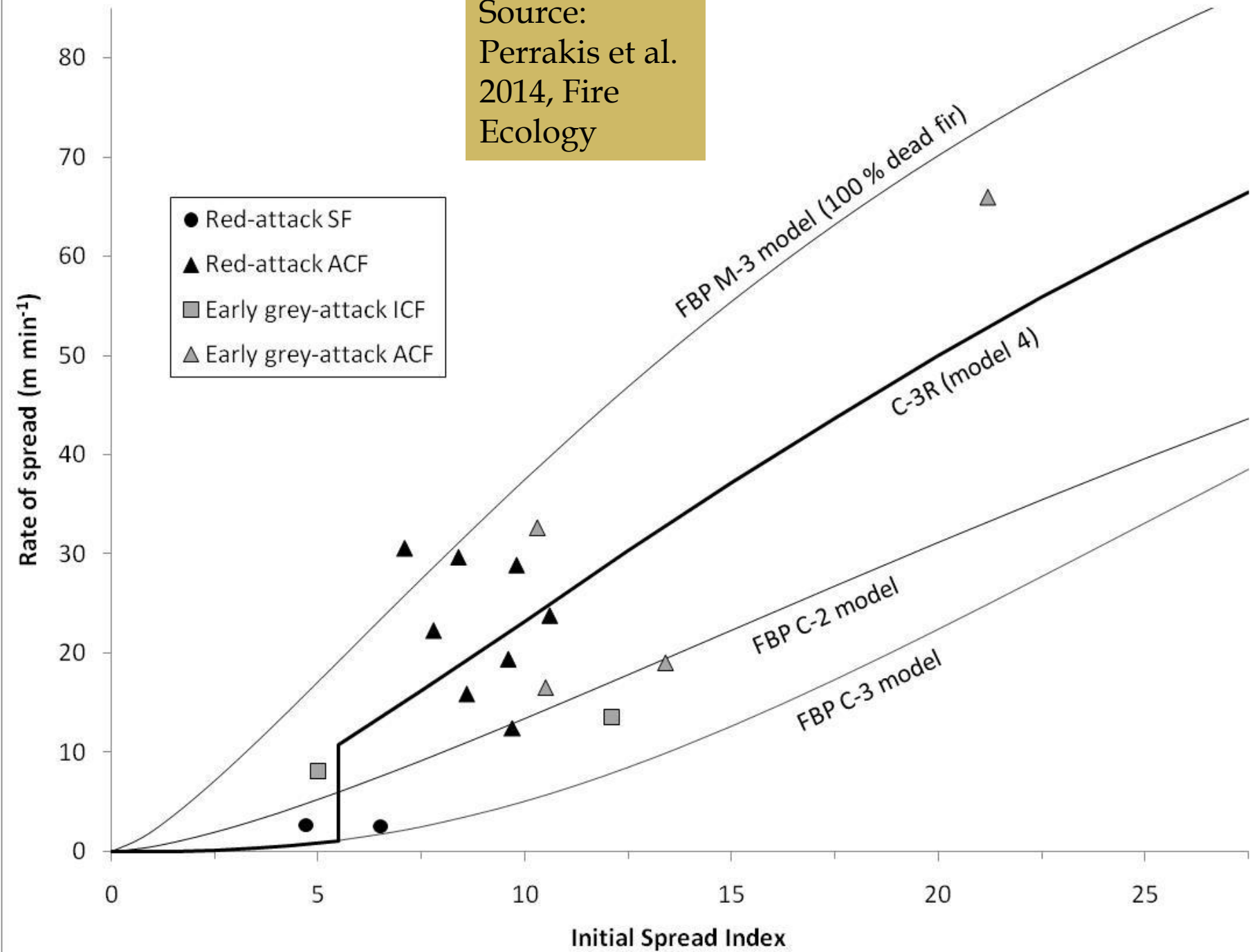


## Previous Focus: C-3R

- Red- attack MPB-affected pine
  - yellow-red-early grey phase, 0-5 years post-attack
- Key fuel type in BC, ~2003 -2010
- Impressive photos, impressive fire behaviour
- Documented & published 2014:
  - 2.7 x faster ROS than C-3, crowning threshold ISI~ 6



Source:  
Perrakis et al.  
2014, Fire  
Ecology



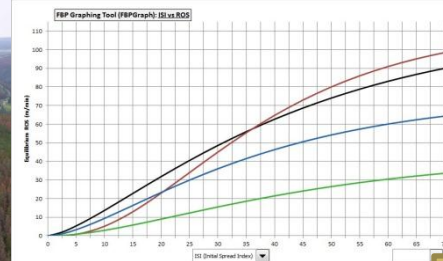




# Things have changed!

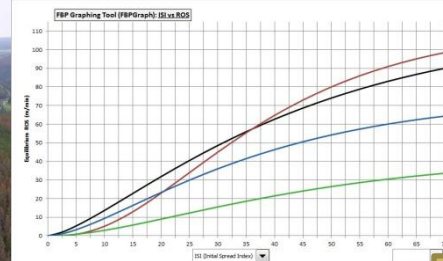
- Red trees lose needles after 2-5 years
- Grey phase now dominant across BC:
  - C-3G – grey-attack MPB-affected pine...





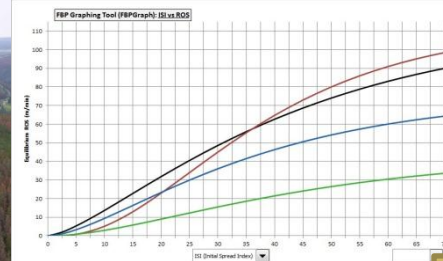
# C-3G

- MPB-affected lodgepole pine
  - (grey phase, 5-15 years post-attack)
- Key fuel type right now! (2010 – 2020?)
- What we know about fire behaviour
  - Crown fire theory
  - Experimental burning (Carrot Lake, other)
  - Wildfire observations/monitoring



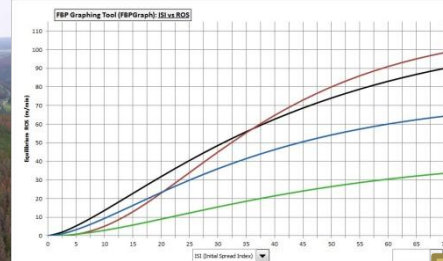
# C-3G: Crown fire theory

- Dead trees are dry...
- Loss of crown foliage countered by increased available small branch fuel
- 'High enough' ROS, high fuel consumption
  - High HFI
- Observations → grey trees do not crown as easily as red
  - But once 'crown-like' fires initiate, can be very high intensity
  - High HFI, high spotting, long residence time → sig. safety & suppression challenges



## C-3G: Experimental Burning (2013)

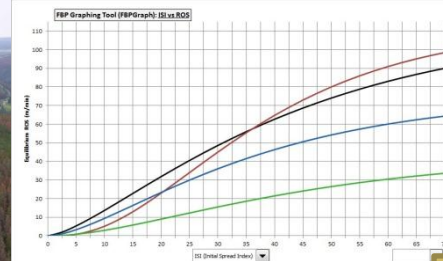
- Current focus is to evaluate fire behaviour (ROS, fuel consump., HFI, spotting) in 'evolving' C-3G
- MPB attack in 2004-2005
- Set up as 2 treatments – thinned, controls
  - Thinning designed to emulate stand fall-down over time



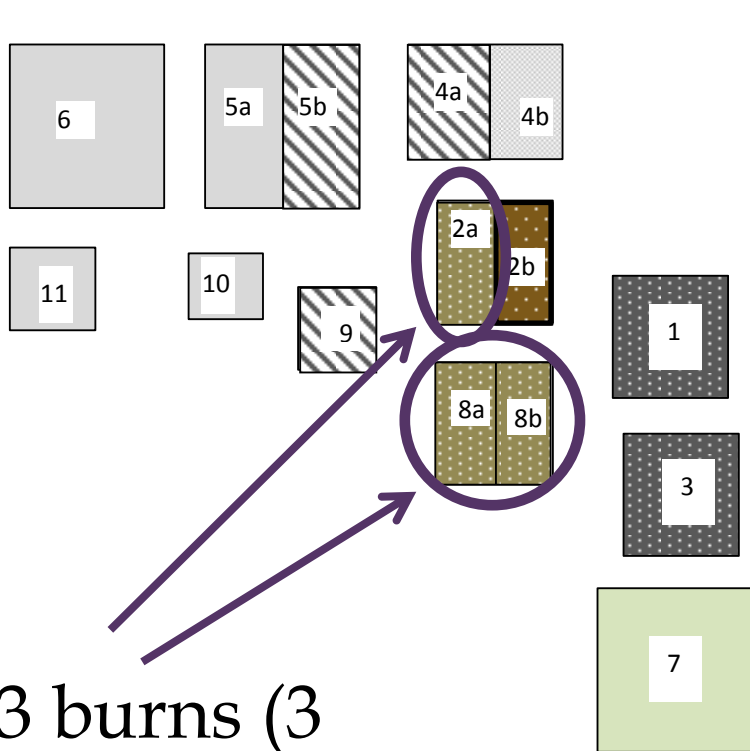
# C-3G: Carrot Lake Exp. Burning Site



2006 G.Earth image



# C-3G: Carrot Lake Exp. Burning Site



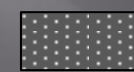
2013 burns (3 half-plots)



2013 burn (C-3G)



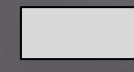
2012 burn (ecology)



2006 burn (C-3R)



Thinned (future burn)



Unthinned (future burn)



Used for other expts



# PLOT 8a/b

Sept.11, 2013

Control (8a) ignited  
at 14:35

Treated (8b) ignited  
at 15:03

**Hourly** (14:00-16:00  
PST)

HFFMC 92 -93

HISI 11 -13

HFWI 33-36

T 28 °C

RH 15-17 %

Wdir 75 °

Wspd 14 km/h

Rain 0.0 mm

**Daily**

FFMC 94

DMC 65

DC 476

BUI 96

FWI 40

T 27 °C

RH 21 %

Rain 0.0 mm





Hand ignition of small windrow of brush treated with petro gel

# PLOT 2a

Sept. 12, 2013

15:08 PST

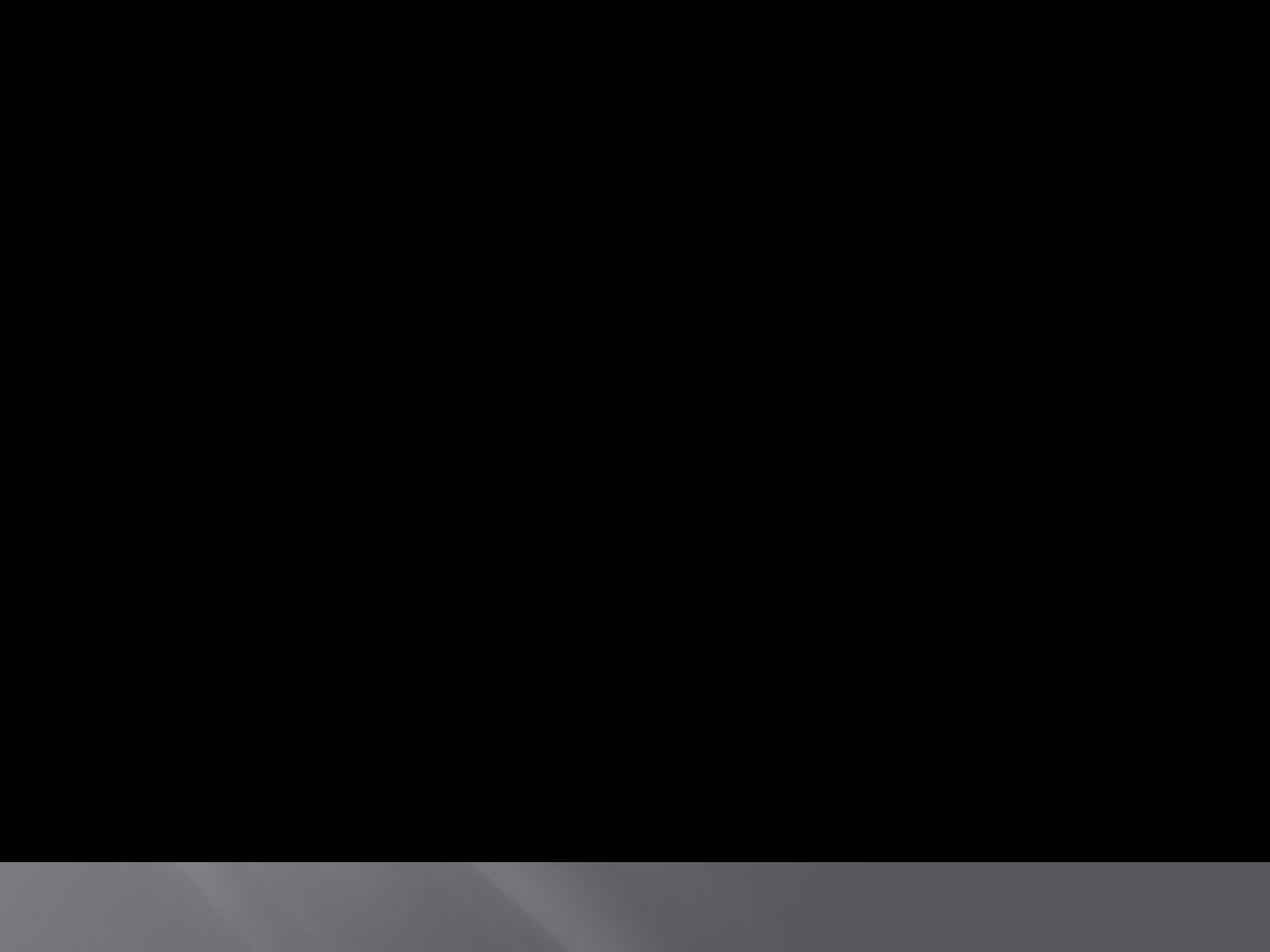


## Hourly (15:00)

HFFMC	93
HISI	13
HFWI	38
T	29 °C
RH	20 %
Wdir	247 °
Wspd	14 km/h
Rain	0.0 mm

## Daily

FFMC	94
DMC	69
DC	482
BUI	101
FWI	36
T	28 °C
RH	24 %
Rain	0.0 mm





# C-3G: Wildfire Monitoring

➤ 2012- 2014 fire seasons





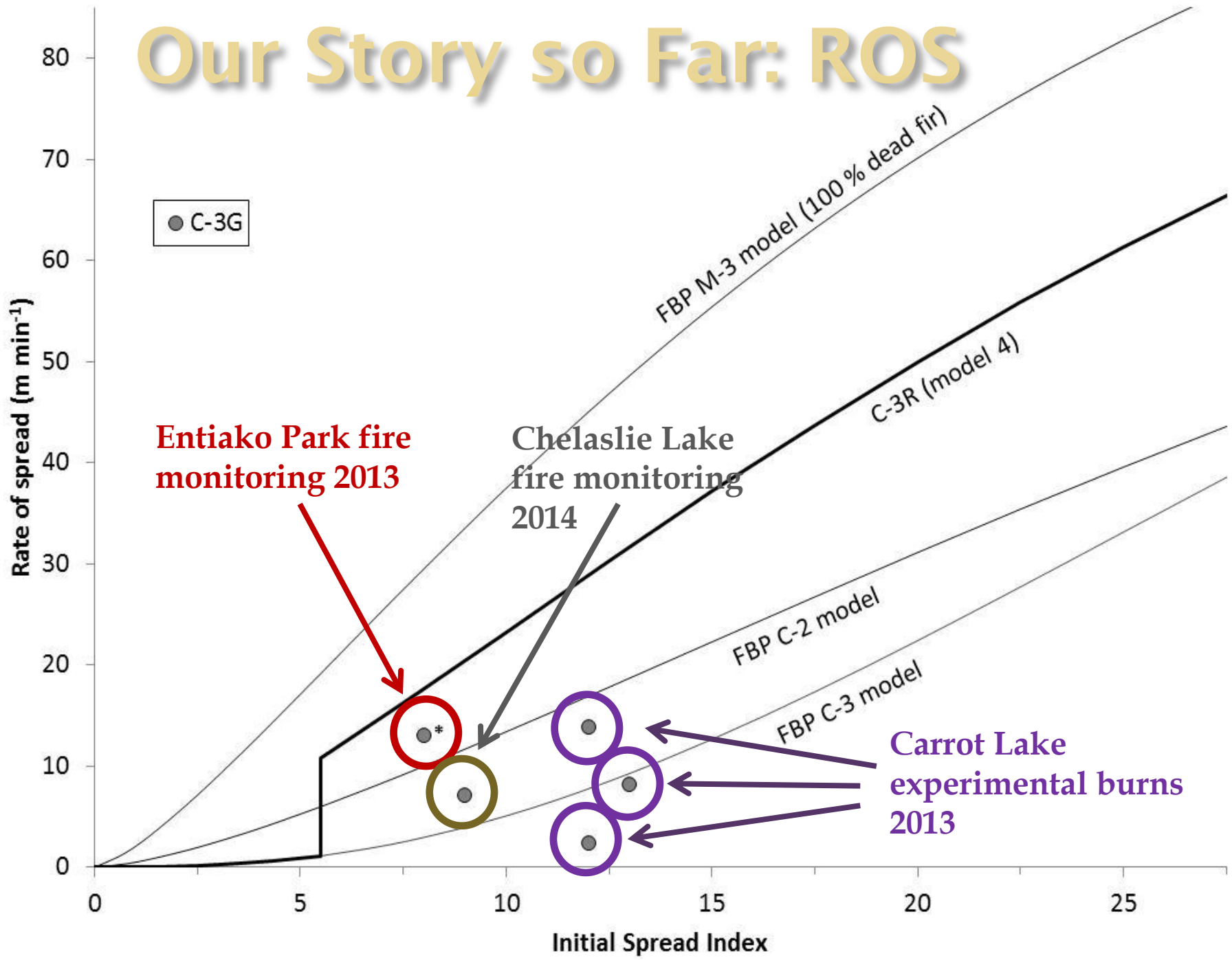
Sept. 13, 2012; Photo: Rob Krause, BC WMB

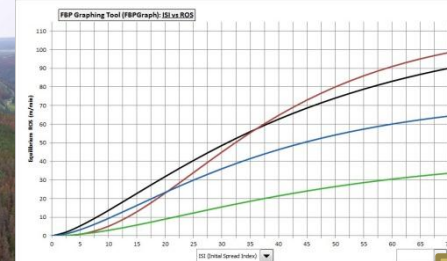


Aug. 11, 2014, 1700: HISI ~15.3, BUI 183, HFWI 50.4

Video: Devon Barnes, BC WMB

# Our Story so Far: ROS





# Our Story so Far: FC and HFI

## Carrot Lake, 2013 C-3G Burns





# Crown fire initiation probably depends on understory structure!



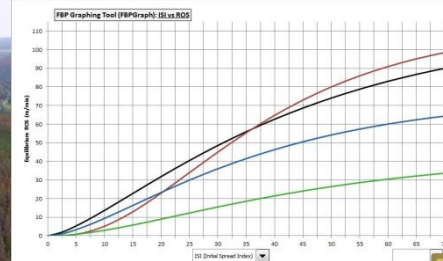
Lush green herbaceous veg.  
(Lower fire risk)



'Classic C-3' understory:  
feathermoss, etc.  
(Surface fire to int. crown  
fire; greater wind  
penetration, faster drying?)

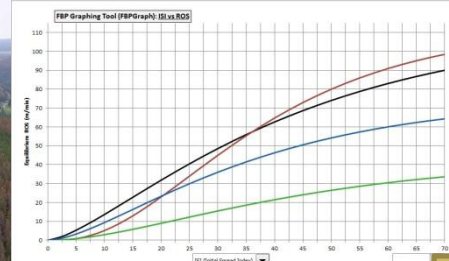


Conifer understory  
(Fast rate of spread,  
High Spotting Potential)



# Monitoring, research continue

- Working model:
  - C-3G appears slightly (?) faster ROS, higher HFI than C-3, but is close
- Current/future plans:
  - More burning at Carrot Lake
  - More operational fire monitoring
  - More data from photo interp.
  - Insight from structural, physical models?
  - Etc.



Thank you!

Questions?