

Dave Schroeder, Alberta SRD

Helpers:

Dana Hicks, BC MoFR

Brad Hawkes, CFS

Steve Taylor, CFS

Rick Kubian, Parks Canada

In Canada 2 insects get the most attention:

## **Spruce Budworm**

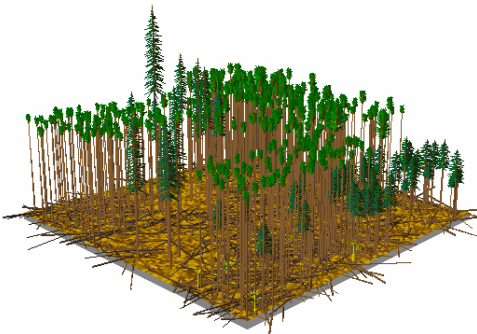
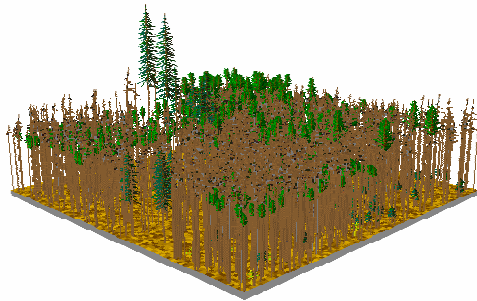
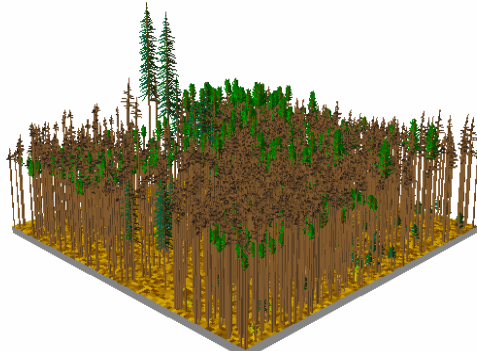
- across Canada but major epidemics in eastern
- Stocks (1987) describes test burns toward FBP fuel types

## **Mountain Pine Beetle**

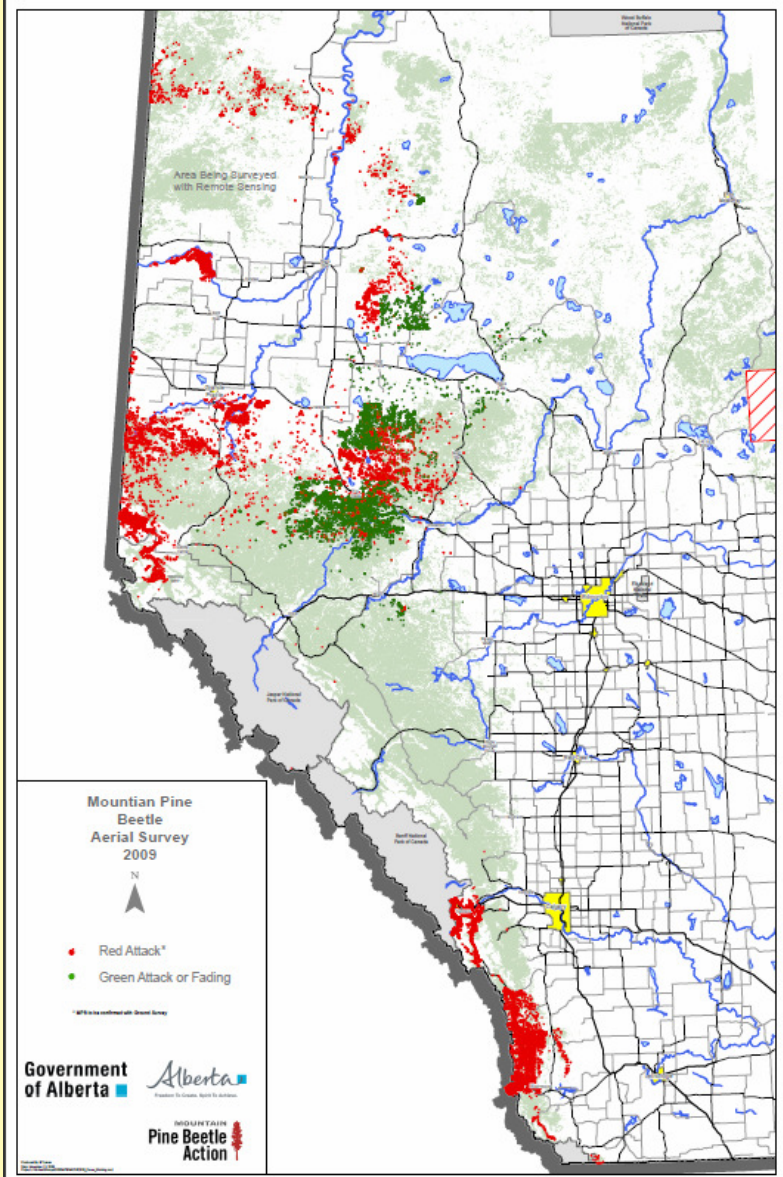
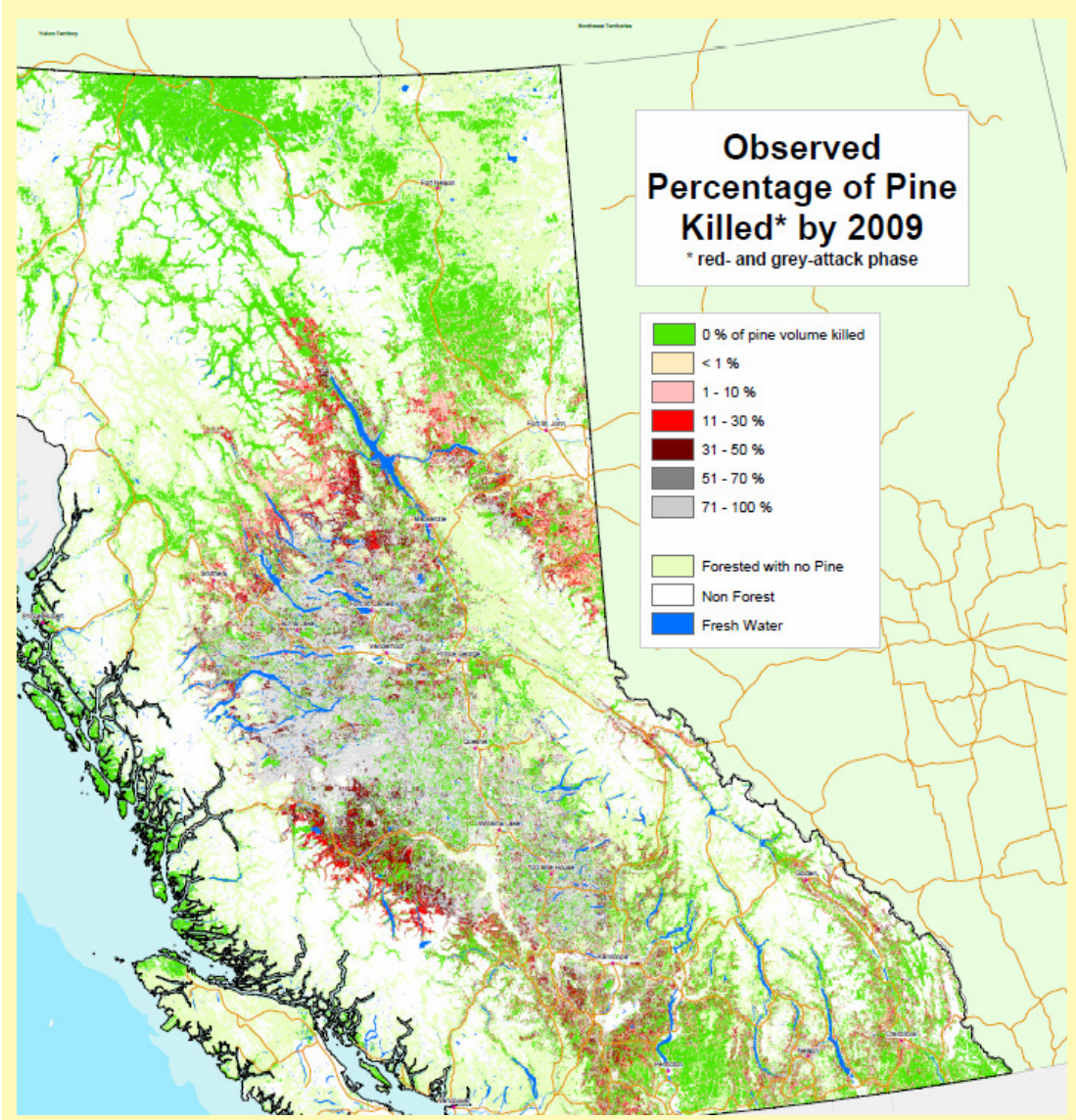
- BC and Alberta (so far)
- No FBP fuel type development
- ? How many have experience?

Rest of presentation will focus on pine beetle

Year 0	Green attack in summer, tree dies
1	Needles turn orange following spring
1 - 3	Needles turn red summer following attack Needles fall over 2-3 yrs
3 - 10	Small branches fall over 3-10 yrs
10-20	Dead boles fall in 10-20 yrs. Large surface fuel accumulation Regeneration of residual stand



# Spatial extent



# Red Attack – Dana Hicks (BC)

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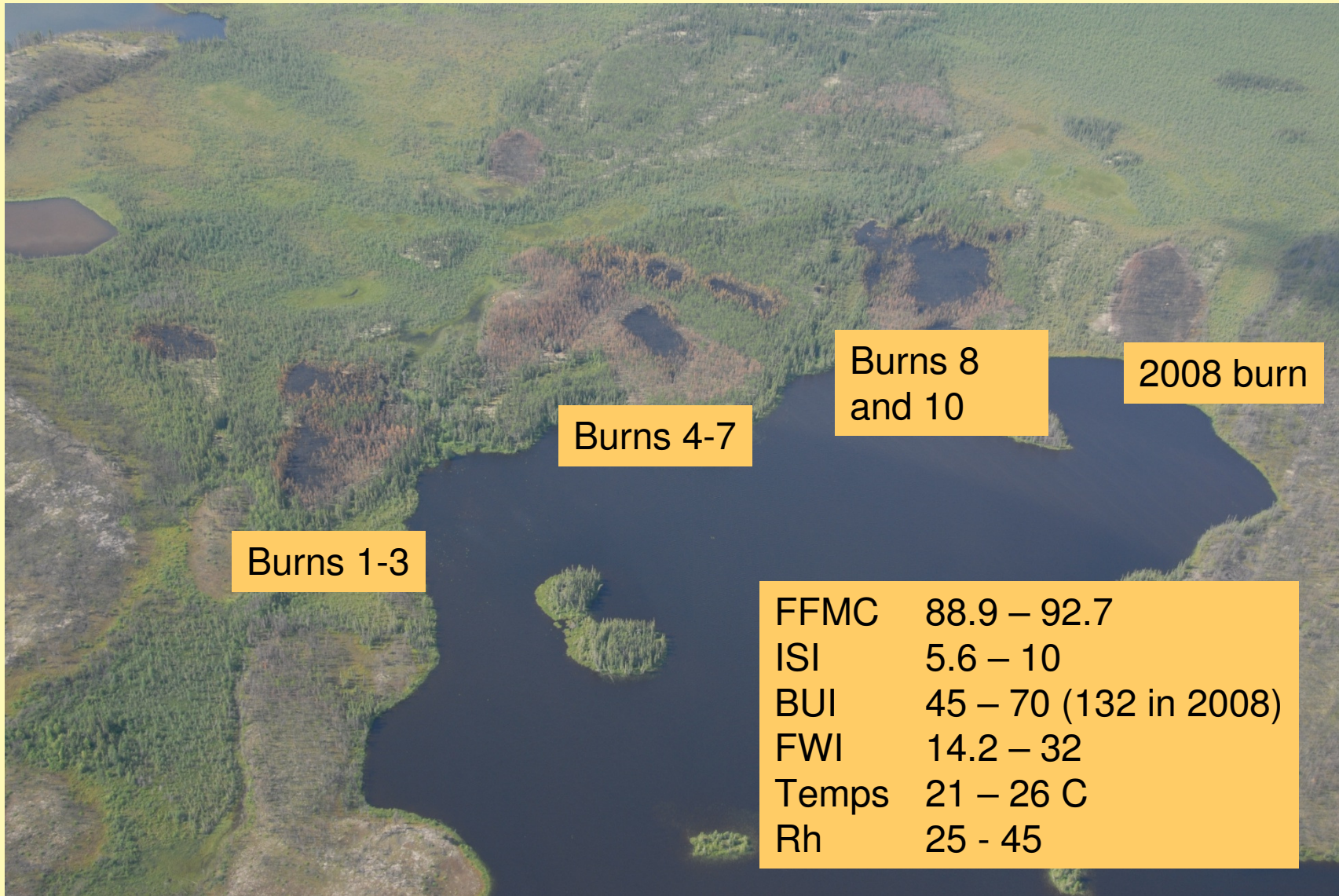


- Think about it as 20 metre standing grass, that responds to changes in moisture very quickly
- Influenced primarily by humidity and FFMC
- 91 FFMC threshold



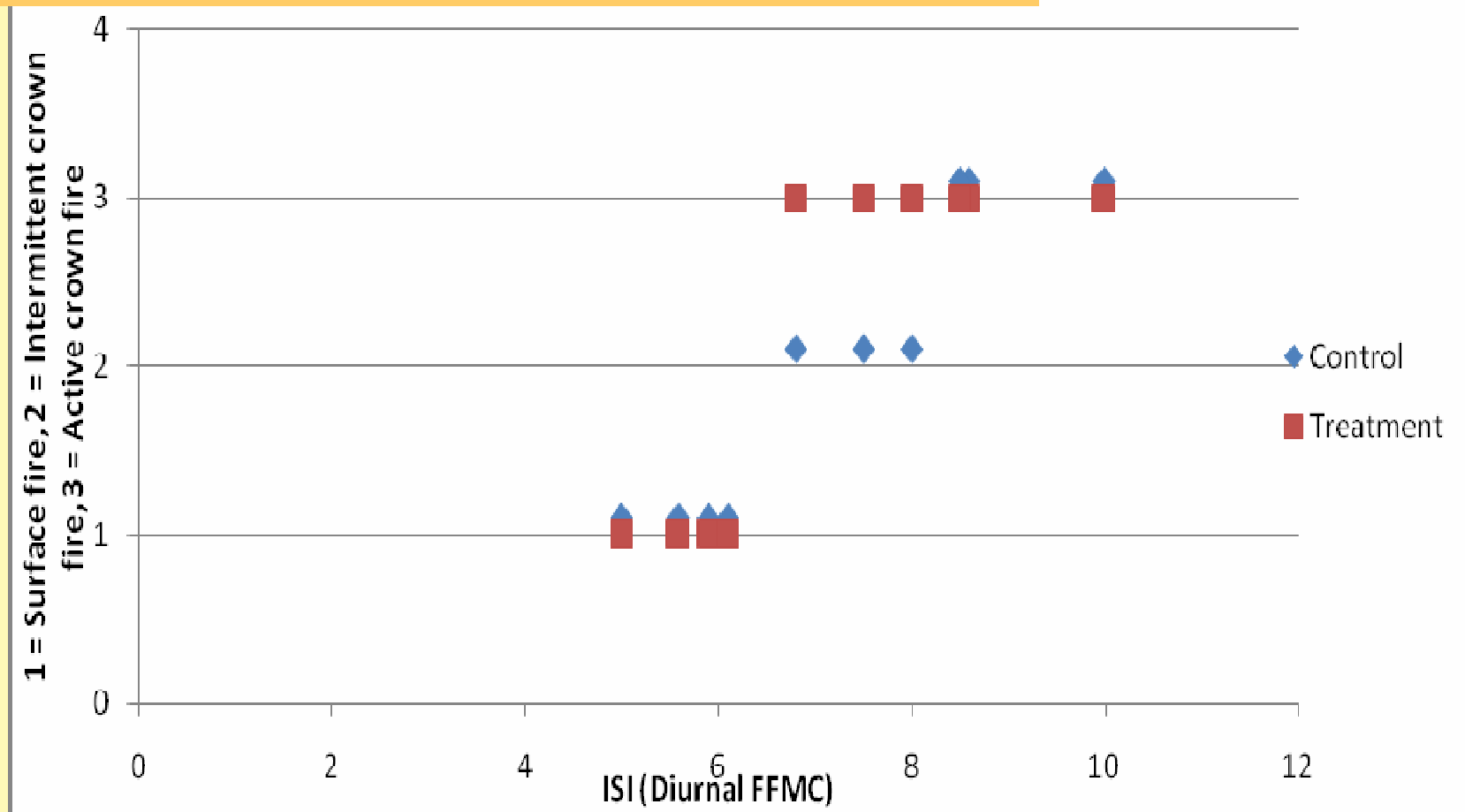
- Does not need a ground fire, can spot from crown to crown.
- Spotting to 300m on the first candle is common.

# Red Attack – Archer Lake



# Red Attack – Archer Lake

- 25 – 40% needles gone in 2009(ocular estimate).
- Red needle moisture similar to litter
- Duff moisture higher in red stands



# Red Attack – Archer Lake

[Video clip](#)



**Several studies suggest post red attack crown fire behaviour may not be worse (compared to unaffected stands)**

**Evidence:**

Decrease in canopy fuel load due to needle cast  
No overall fuel build up effect detected in empirical data

**Estimates:**

Fire behaviour models indicate higher surface fire ROS but less active crown fire

- Page and Jenkins (2007)
- Tinker et al (2006)
- Simard et al (in press)

**? Is Active crown fire a useful definition for grey attack fires – with little crown material ?**

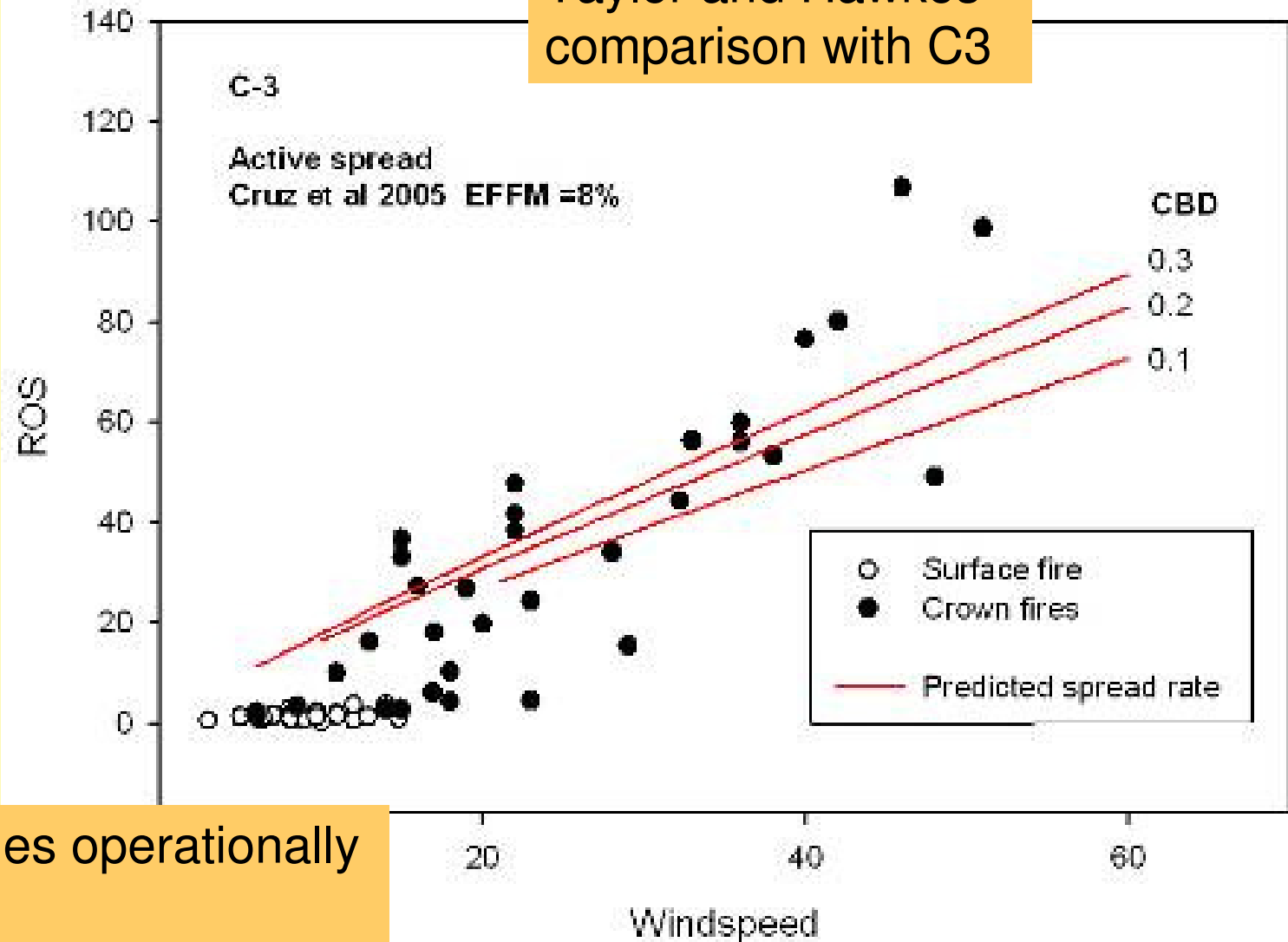
# Grey stages: Years 3 – 10

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# Grey stages: Years 3 – 10

Taylor and Hawkes comparison with C3



ROS changes operationally significant?

# Grey stages: Years 10- 20

- stem fall increases surface woody fuel loading
- increase in surface fire intensity and flame length understory
- vegetation (grass, herbs, shrubs) and residual trees may be released due to increased light levels and reduced competition.



Waterton National Park 20 years following MPB attack  
Photo: Canadian Forest Service



# Grey Stage – Mitchell Ridge (Parks Canada)

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# Grey Stage – Mitchell Ridge (Parks Canada)

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Moderate to  
steep slopes (30  
deg used in fire  
behaviour calcs)

Heavy surface  
fuels from MPB  
20 years ago.



# Grey Stage – Mitchell Ridge (Parks Canada)

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Spring burn (early June)  
FFMC = 91, BUI = 42  
ROS variable, affected by spot  
fires. 27m/min used for intensity  
calcs

# Grey Stage – Mitchell Ridge (Parks Canada)

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# Grey Stage – Mitchell Ridge (Parks Canada)

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# Grey Stage – Mitchell Ridge (Parks Canada)

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# Wrap up

- Drier fuels (needles, standing dead, dead and not all the way down)
- Head fire ROS does not seem to be a lot different.
- Head fire intensity is greater.
- Ember transport = BAD, Bark flakes in grey stage = REALLY BAD
  - Accelerate ROS (equilibrium prior to head fire arrival)
  - New fires
  - Critical for Community/Structure protection.
- Relaxed debris management rules make problem worse

## Wrap up

- What happens in grey at high BUI's?
  - Soil degradation?
  - Greater carbon release?
- As a PB person I recommend more burns at low intensities (e.g. Mitchell Ridge)!
- Do we need to develop new fuel types or does ember transport override?