Effects of Simulated MPB on Hydrology and Post-attack Vegetation & Below-ground Dynamics

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Broad research questions

• *How much extra water is produced after different levels of “red attack”*? (Pablo Piña)

• *What are the early trajectories of vegetation and below-ground responses after different levels of “red attack”*? (Anne McIntosh)
Approach & treatments

• Simulate MPB attack
  - issue of “control” (B.C. experience)
  - variable density herbicide treatment

• [1] Control (untreated)
• Simulated MPB attack ([2] 50% & [3] 100% overstory kill)
• [4] Clearcut - harvested to simulate “salvage logging”
Study area & design

- Process study

- Pre-treatment (1 year)
- Post-treatment (2 years)

- 2.2 ha treatments (water balance)
- + 2 x 1.2 ha replicates (vegetation)
50 % MPB ATTACK

CLEARCUT

100 % MPB ATTACK

CONTROL
Post-attack hydrology responses
Pablo Piña, PhD Candidate

How much extra water is produced after different levels of “red attack”?
Forest stand water cycle

Gross precipitation + Evaporative demand

Overstory transpiration

Canopy interception

Forest floor interception

Soil moisture storage
Transpiration instrumentation

Thermal Dissipation Probe
OVERSTORY TRANSPIRATION DURING 2010 SEASON:
• CONTROL 65 mm (29% of precipitation)
• 50% KILL 36 mm (16% of precipitation)
• 100% KILL 11 mm (5% of precipitation)
Post-attack vegetation & below-ground responses
Anne McIntosh, PhD Candidate

What are the early trajectories of vegetation and below-ground responses after different levels of “red attack”? 
Overstory

Understory

Belowground

? MPB
Post-attack vegetation & below-ground response objectives

*What are the early trajectories of vegetation and below-ground responses after different levels of “red attack”?*

1. Overstory forest structure
2. Understory plant community composition (shrubs, seedlings, plants (herbs, grasses, bryophytes))
3. Future regeneration potential of these stands
4. Recruitment of downed woody debris (DWD)
5. Changes in below-ground processes (nutrient availability, microbial community, decomposition)
Germination study (2010)

What is the regeneration potential of these stands after MPB?

Quadrats on 5 substrates sowed w/ seed:
- LFH < 2.5 cm
- LFH > 2.5 cm
- Mineral soil
- Moss
- Dead wood (decay class 4-5)

Monitored germination weekly
Germinants

Mean number of germinants counted

- Deep litter
- Shallow litter
- Moss
- Mineral
- Dead wood

Treatment

Control | 50%kill | 100%kill | Salvage

Mean number of germinants counted
Recap & the future...
Forest stand water cycle

- Canopy interception
- Net precipitation
- Overstory transpiration
- Forest floor interception
- Soil moisture recharge
Main findings (mid-way 2nd post-treatment yr)

Treatments: represent a gradient of MPB attack

Stand evapo-transpiration reduced by treatments
  • Less transpiration: red (dead) and treated green trees
  • Untreated trees aren’t transpiring more

Soil moisture increased
  • Surface 20 cm clear treatment effect
  • Surface 5 cm clear gradient with treatment
Overstory
Trees are dying

Understory
*No change... yet?

Regeneration?
Potential 😊

Below-ground
No change ...
yet?
*not all data

MPB
As we move to grey attack...

- Transpiration
- Interception
- Soil water
- Soil nutrients
- Understory cover
- Species-specific responses

Future forest development

Below-ground communities
Below-ground processes

Understory community change

Recover water balance?

Light?
Support for the work

- Foothills Research Institute
- FRIAA / AB SRD
- West Fraser Timber Co. Ltd.
- NSERC
- CONACYT
- Milo Mihajlovich
- Field Assistants

...Thank you for listening

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Before
Stand (mm day^{-1})

After

Control 50% Kill 100% Kill

0.0 0.2 0.4 0.6 0.8

0.13 mm
0.38 mm
0.55 mm