

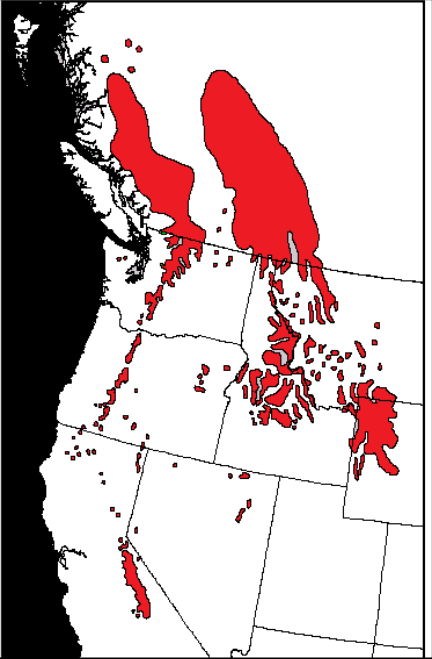
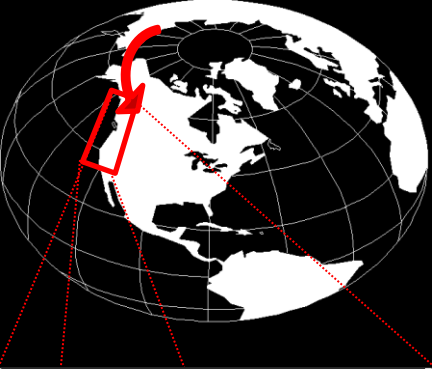
# Mountain pine beetle phenology and success in whitebark pine in Alberta

Evan Esch<sup>1</sup>, A. Rice<sup>1</sup>, D. W. Langor<sup>2</sup>, & J.R. Spence<sup>1</sup>

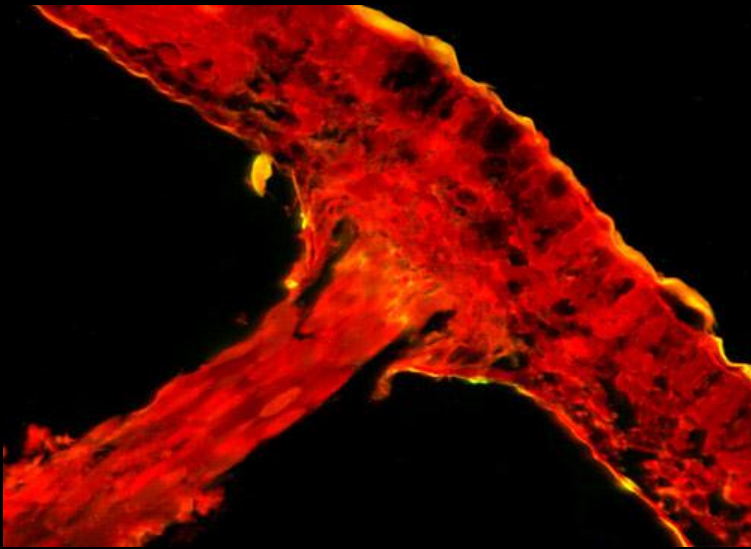
1 University of Alberta

2 NRCAN Northern Forestry Center

# Whitebark Pine (*Pinus albicaulis*)



# White Pine Blister Rust (*Cronartium ribicola*)

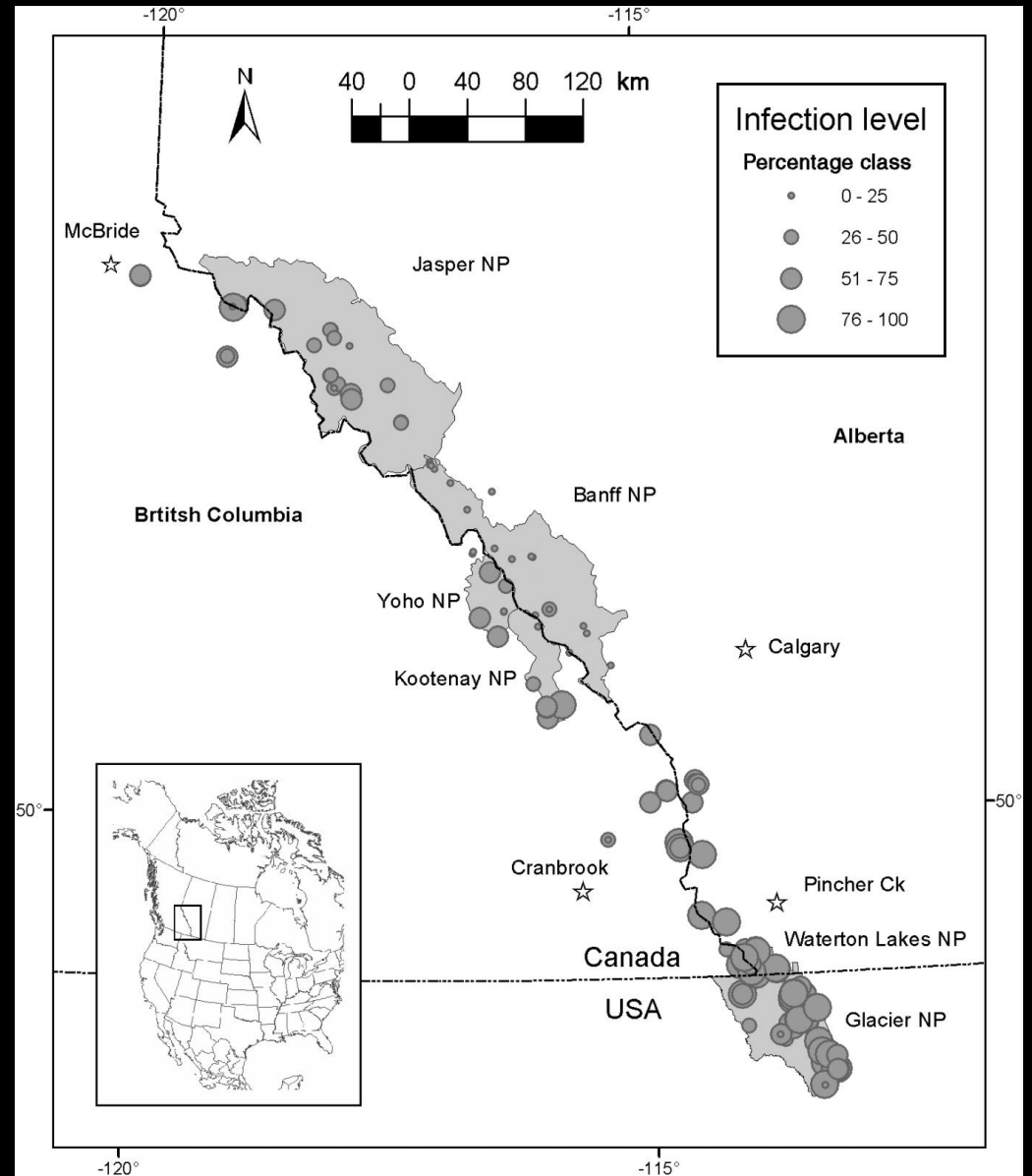


# White Pine Blister Rust never sleeps

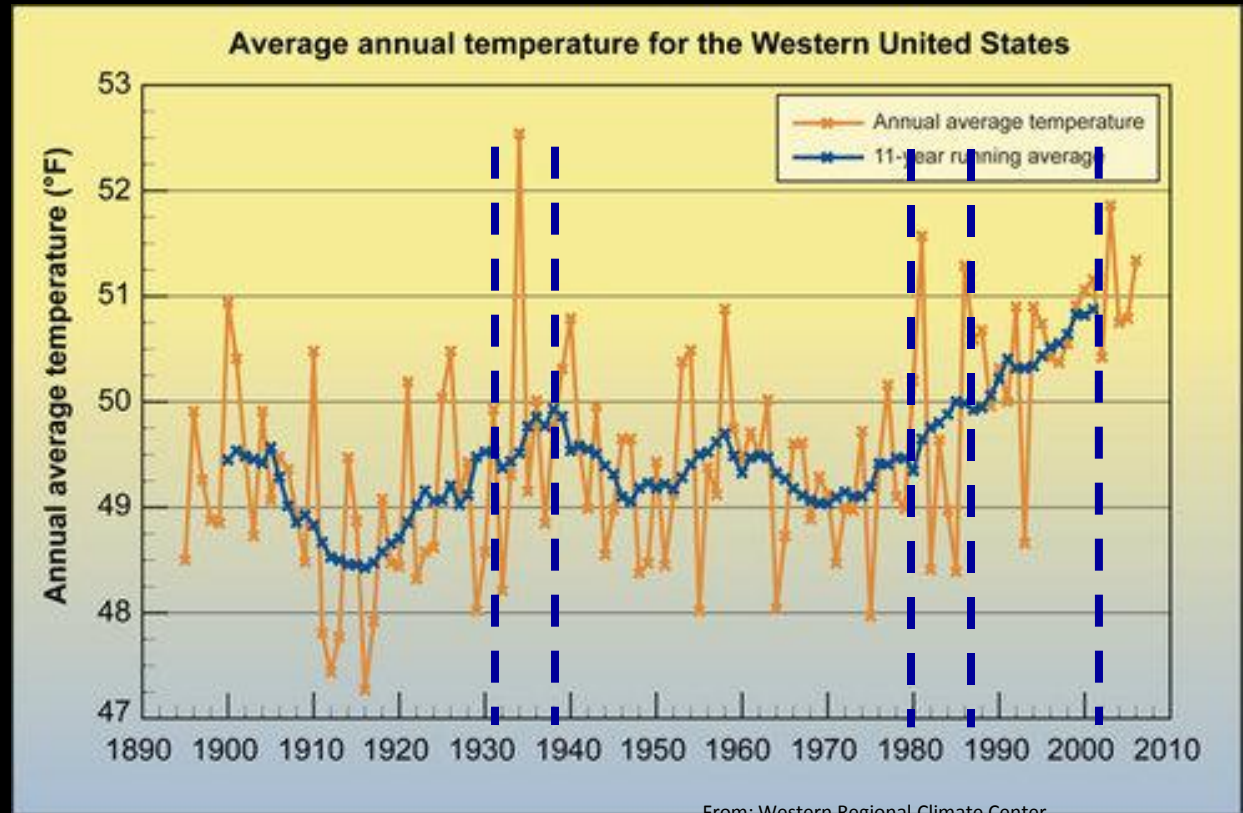
Present in 98% of the species range

Stand level infection rates 0-100%

Some suggest 90% decline in abundance of this species during past century



# Recent history of mountain mine beetle in whitebark pine



Southern Alberta (1976-1981) Whitebark pine mortality observed (Hiratsuka *et al* 1982)

# Knowledge Gaps

## Host Selection



## Host Quality



## Phenology



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Host Selection



Host Quality



Phenology



# Objectives

- Compare MPB phenology and survival between whitebark and lodgepole pine



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- Compare MPB fecundity and condition between whitebark and lodgepole pine
- Compare the virulence of MPB associated blue stain fungi between whitebark and lodgepole pines
- Compare the communities of natural enemies, secondary bark beetles, and associated invertebrates between whitebark and lodgepole pine

# Lab experiment



25 Lodgepole bolts

25 Whitebark bolts



2 galleries initiated/bolt



# Measuring MPB life-history traits

Size



Mass



Body Fat



# Brood Success



## Brood Production in Lab

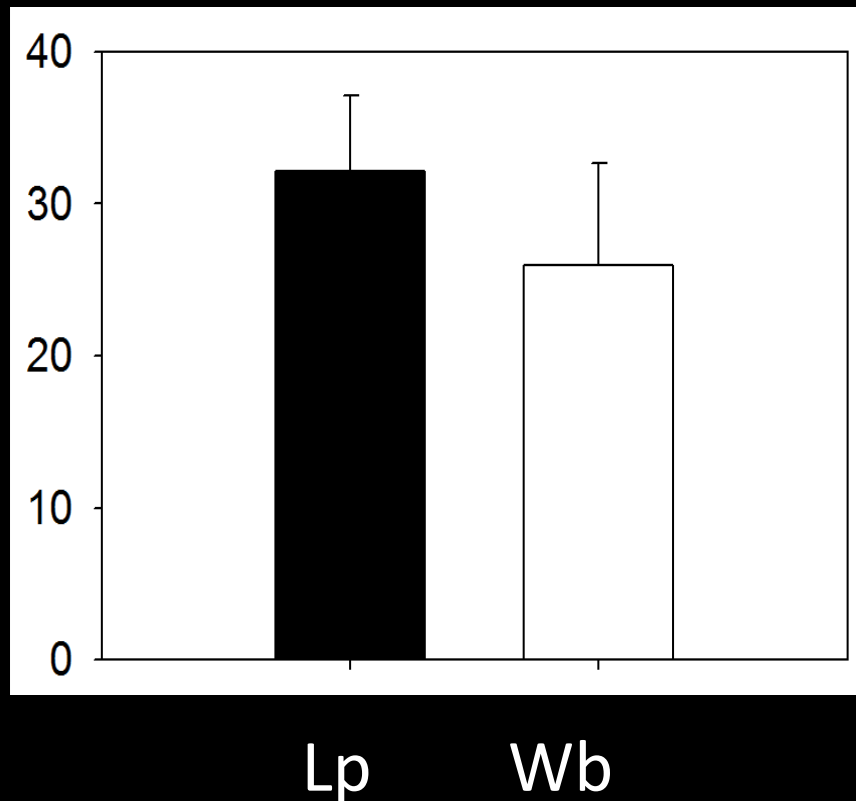
Host	Attempted	Successful
Lodgepole	49	27
Whitebark	53	17

### Logistic Regression

Host	$\beta=2.4$	$p<0.001$
Phloem	$\beta=21.1$	$p<0.001$
Bolt Size	$\beta=0.1$	$p=0.12$

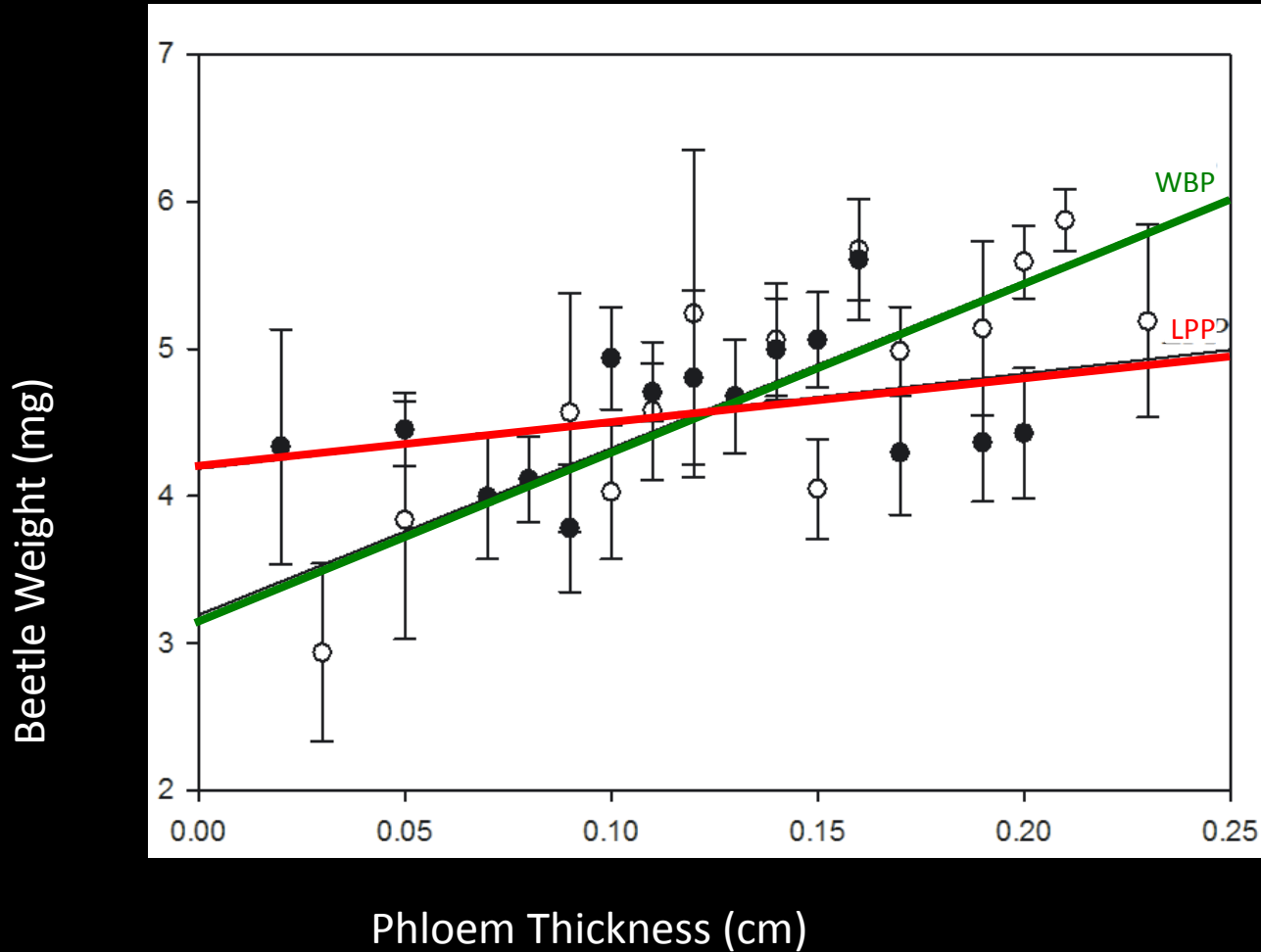
GLM (link=logit)  $\in B(n,p)$

Adults /gallery  $\pm$  1 SE



GLM (link=log)  $\in P(\lambda)$ ,  $df=39$ ,  $t=1.086$ ,  $p=0.284$

# Weight



GLM (link=ident)  $N(\mu, \sigma^2)$

Species \* Phloem

df=57

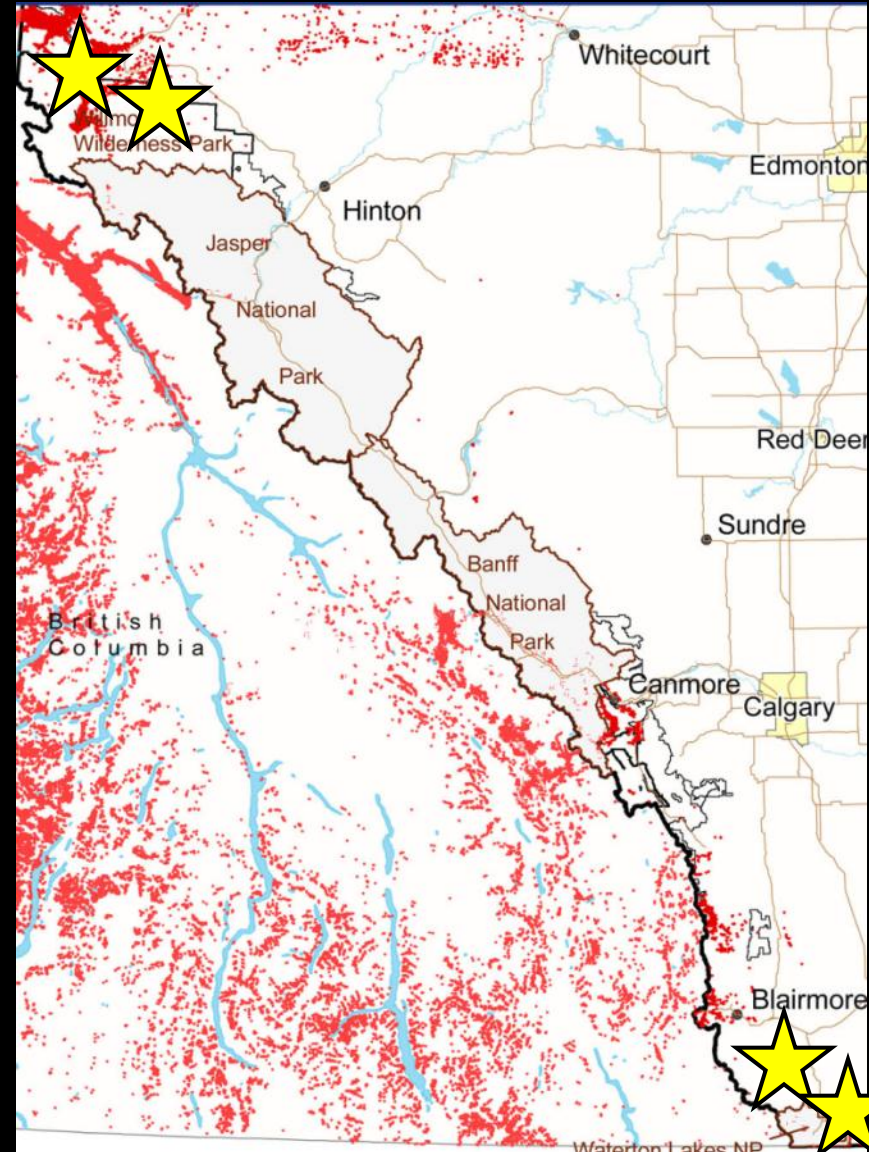
t=4.608

p<0.001

# Field experiment

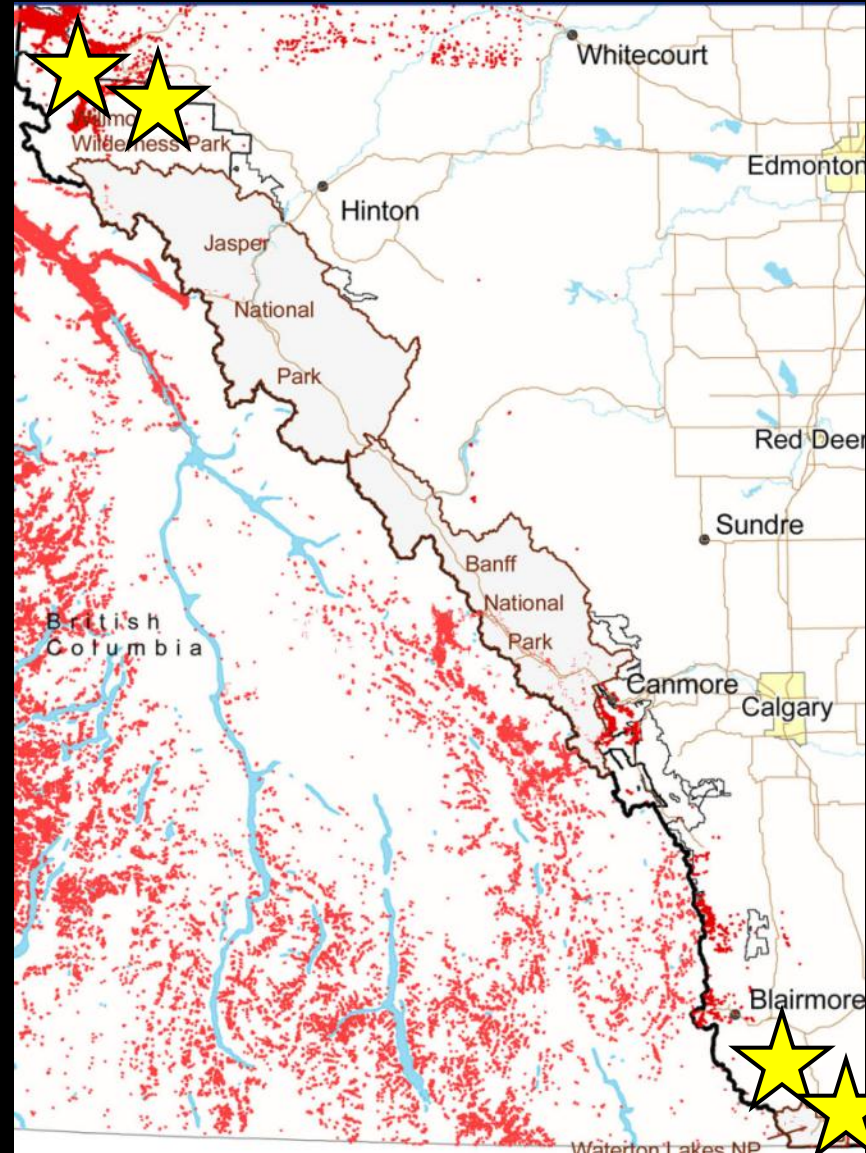
Willmore Wilderness 2008-2009

Crowsnest Pass 2009-2010

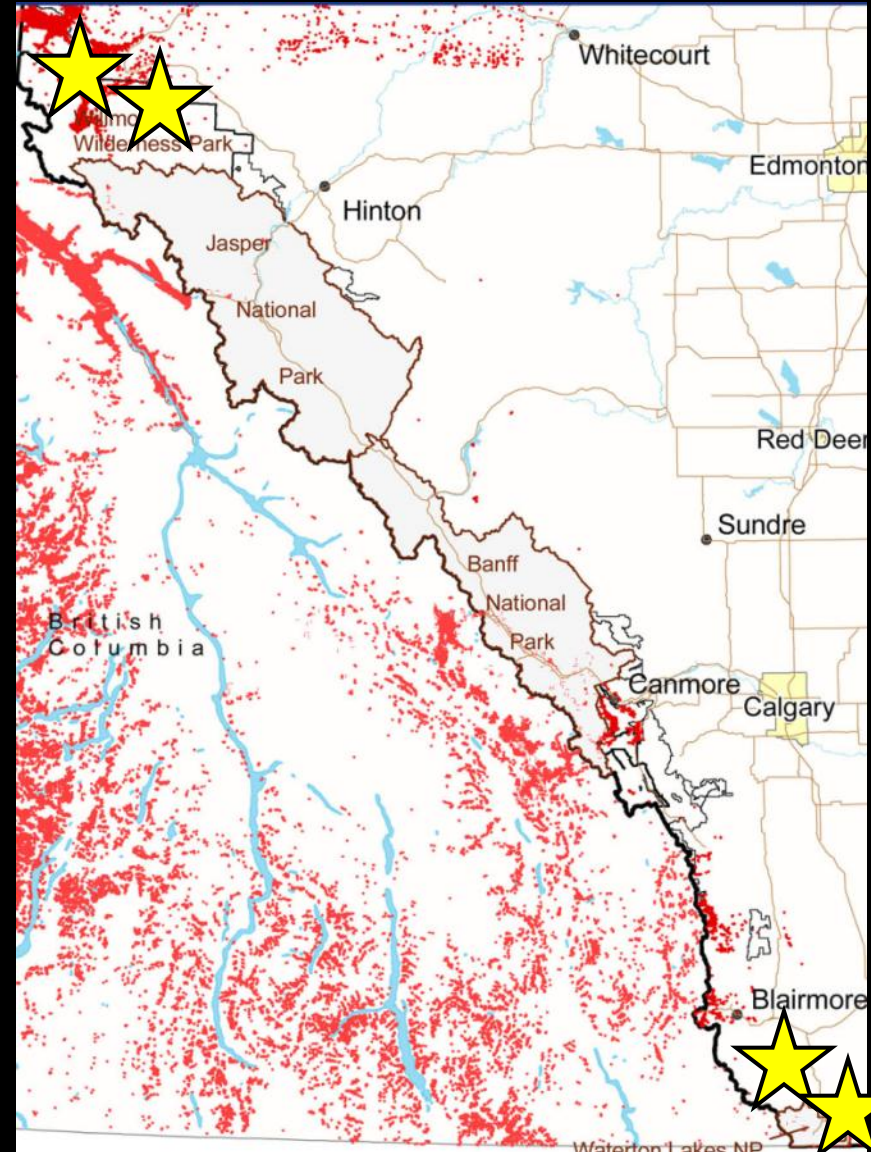




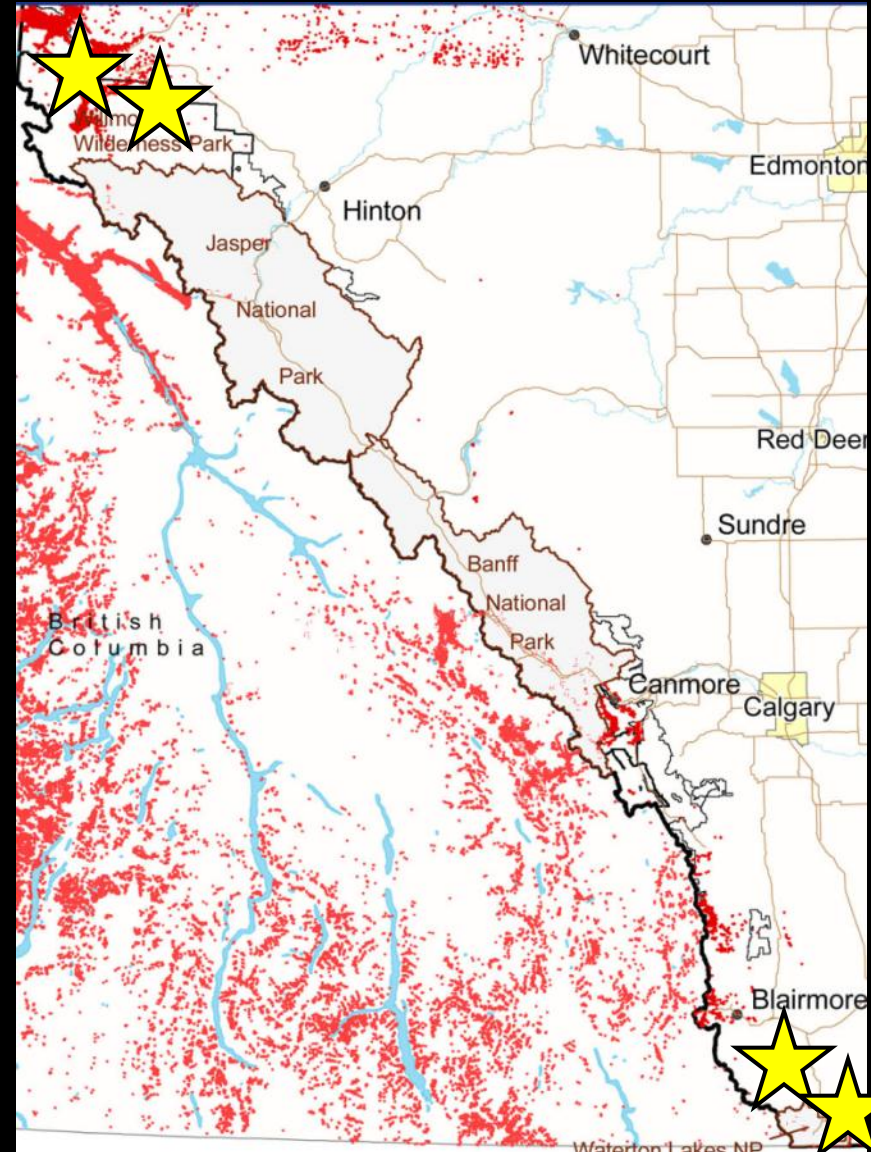
# Field experiment



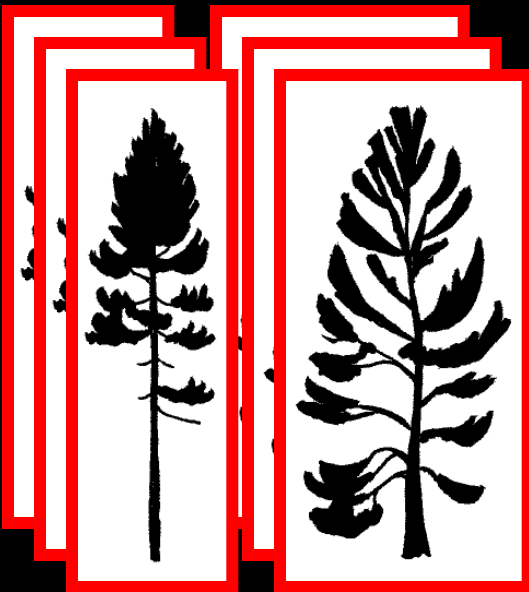
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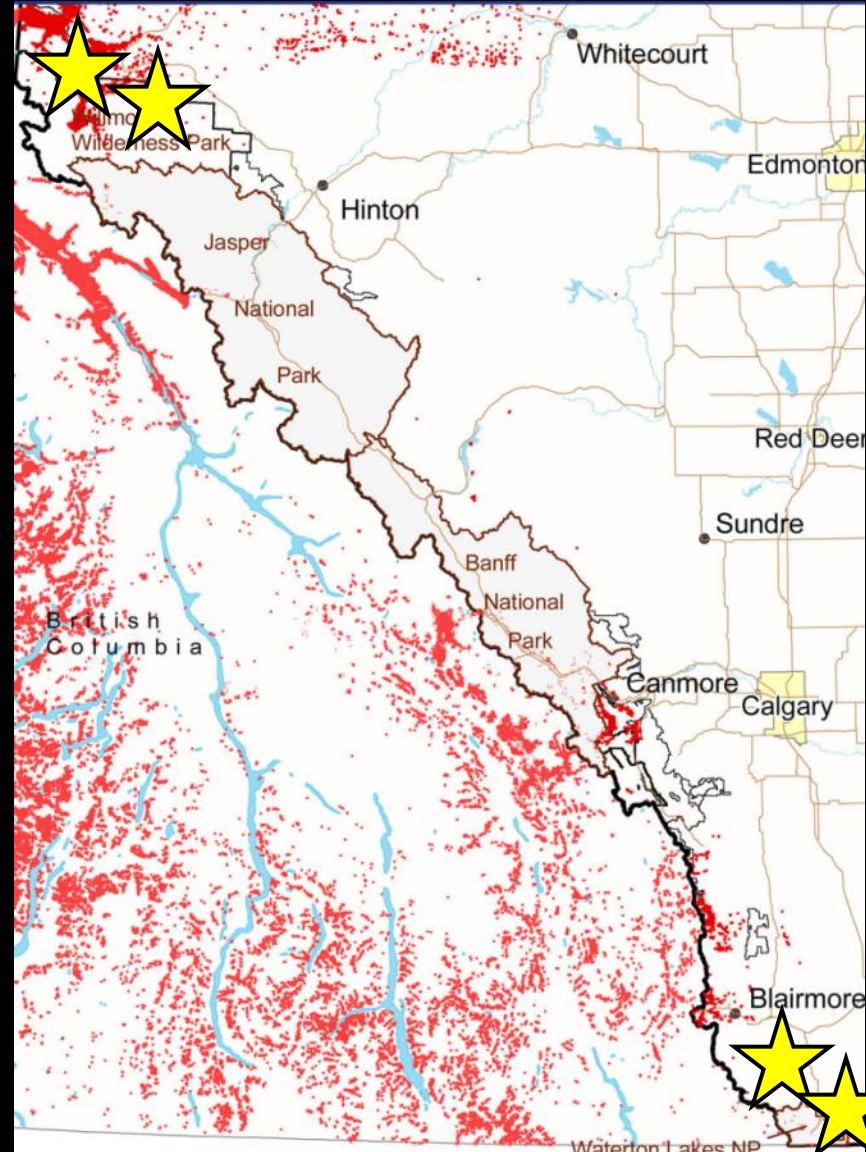
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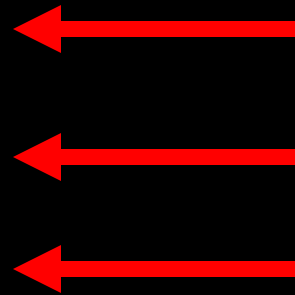
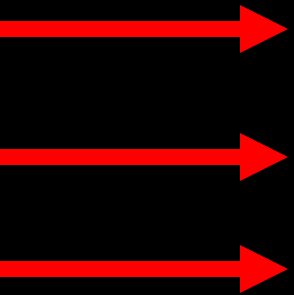
X 3

6

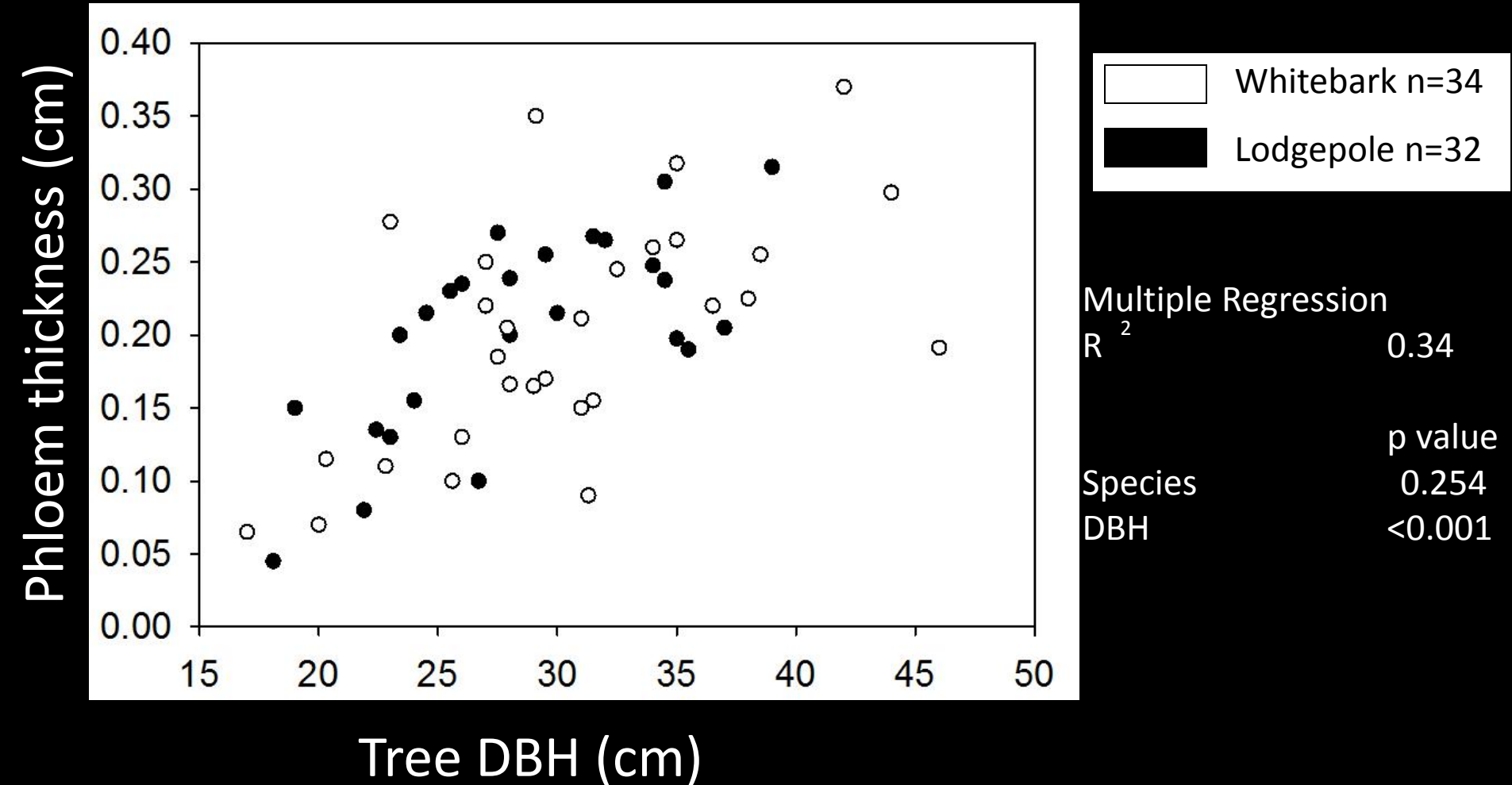
X 3



# Field experiment



# Results: Phloem thickness



# Field Experiment



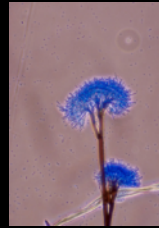
- Beetles can complete life cycle in 1 year, even at high altitudes and latitudes
- Beetle survival in whitebark pine highly variable
- Differences in stage dependant mortality between hosts

# Tree defense

Grosmannia clavigera



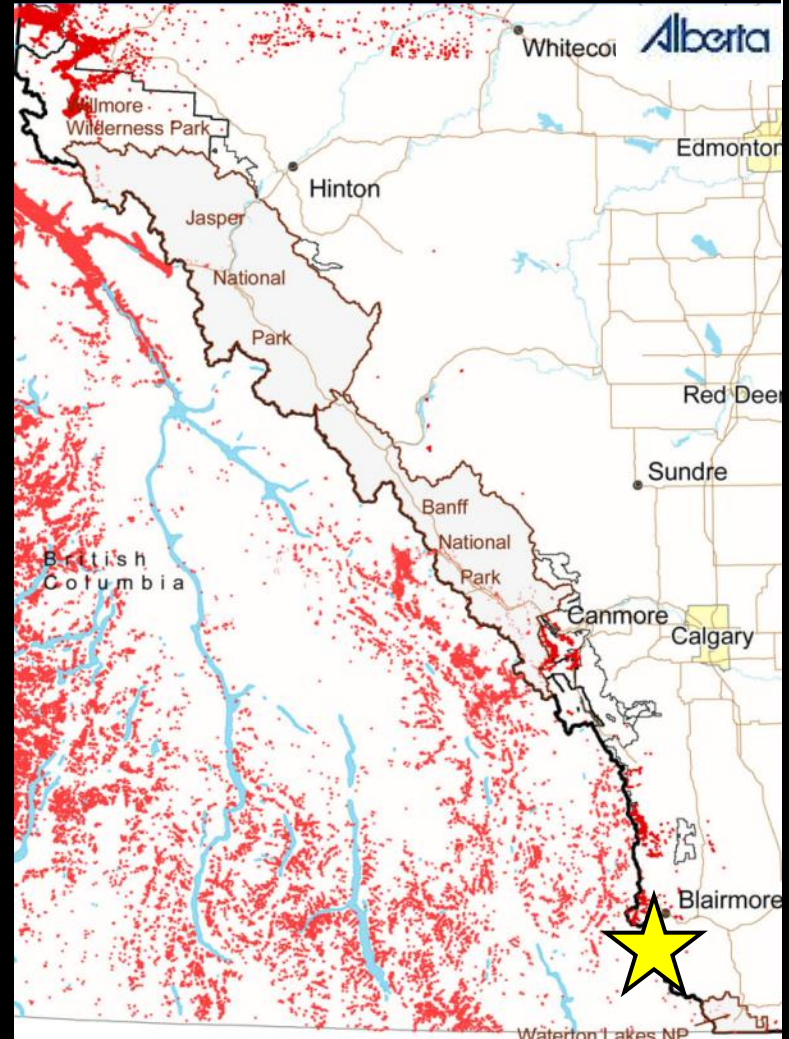
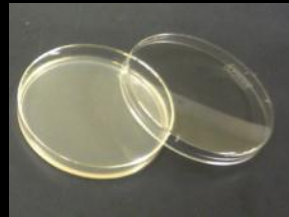
Leptographium longiclavatum



Ophiostoma montium



Agar control

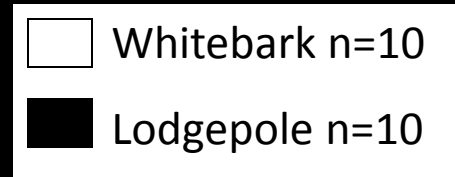
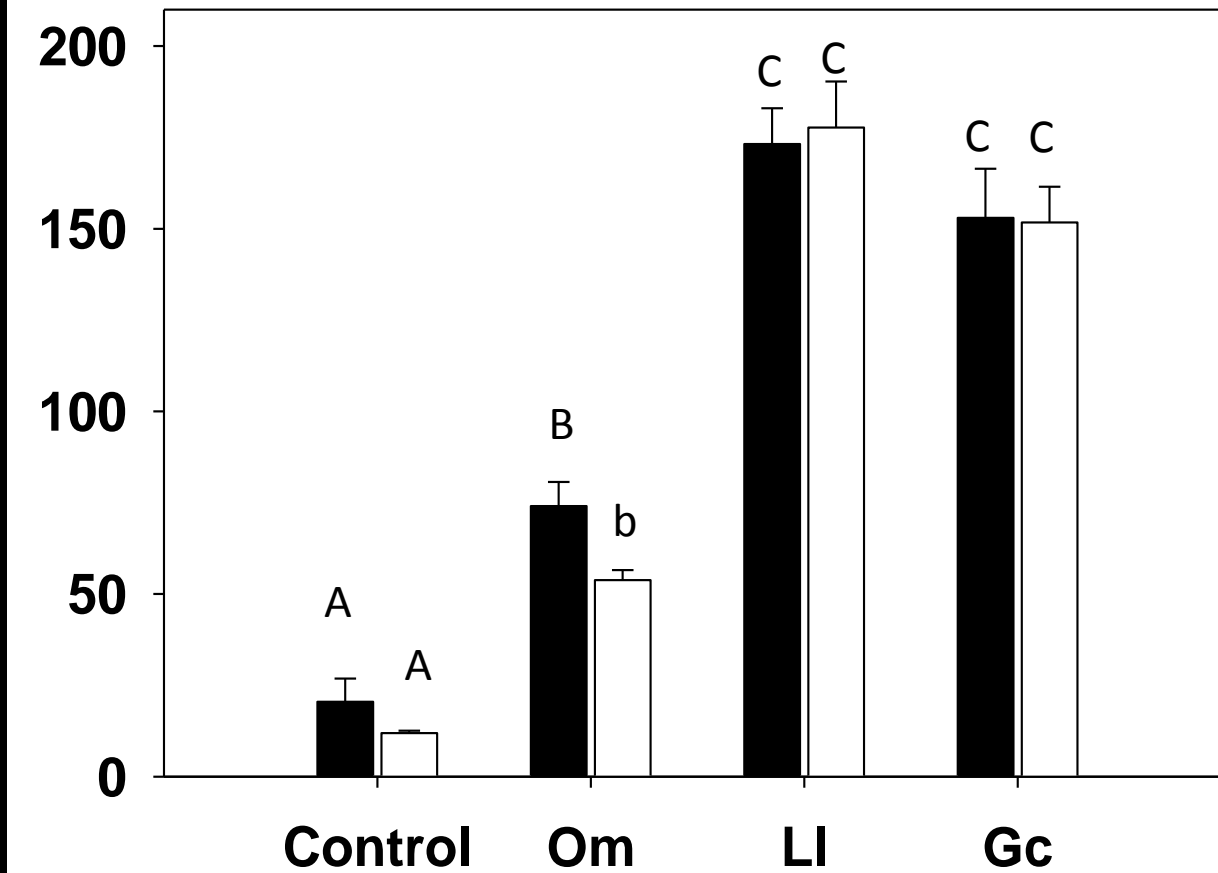




# Tree defense



Lesion length (mm) + SE



Inoculum

# Other research: natural enemies, secondary bark beetles and invertebrate diversity



# Conclusions

- Whitebark pines with thick phleom are excellent hosts for the mountain pine beetle, but trees with thin phloem are not.

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- No differences in phloem thickness observed between hosts (yet), but differences in survival and stage dependant mortality evident.
- Strength of immune response similar between the two hosts.
- Interesting and potentially unique invertebrate fauna associated with whitebark pine.

# Acknowledgements

- D. W. Langor, J.R. Spence, N. Erbilgin
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- Phillip Hoffman & Christine Twerdoclib
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Natural Resources  
Canada



# Questions

