

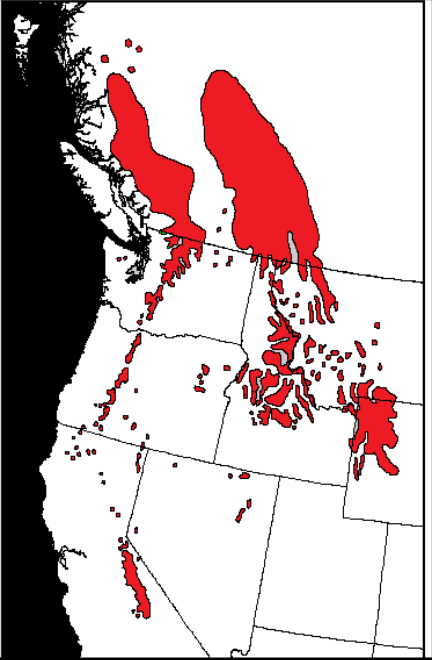
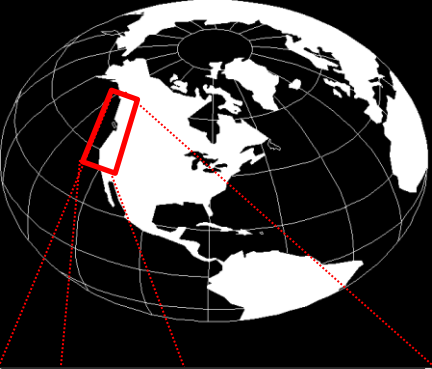
Mountain pine beetle phenology and success in whitebark pine in Alberta

Evan Esch¹, A. Rice¹, D. W. Langor², & J.R. Spence¹

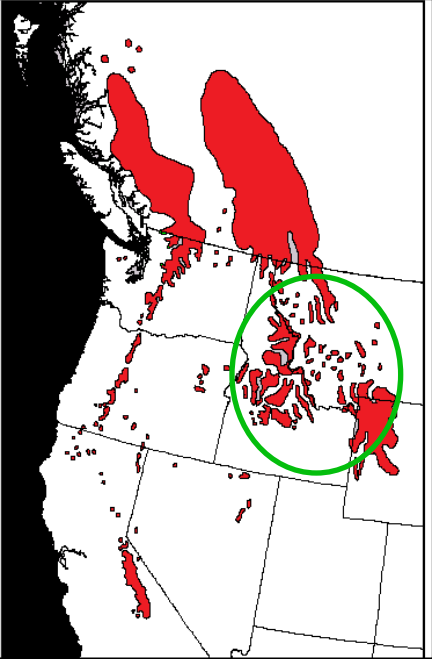
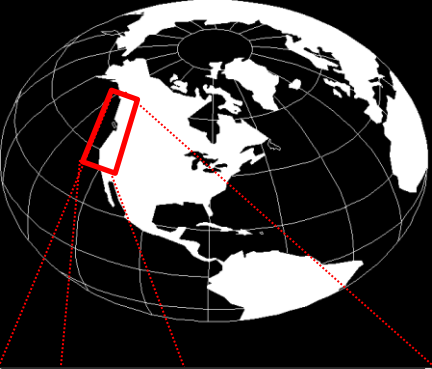
1 University of Alberta

2 NRCAN Northern Forestry Center

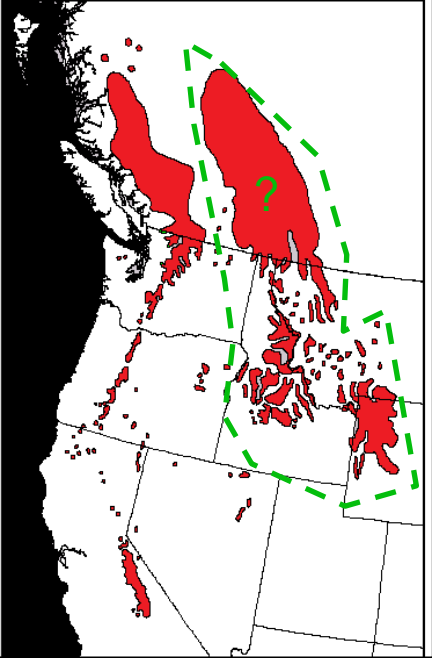
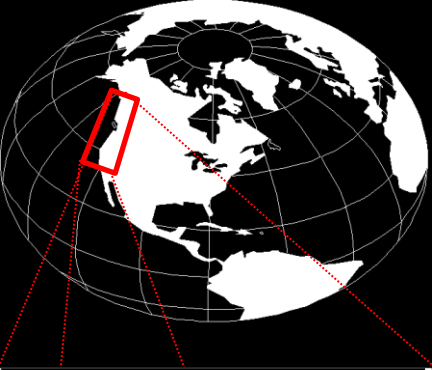
Whitebark Pine (*Pinus albicaulis*)



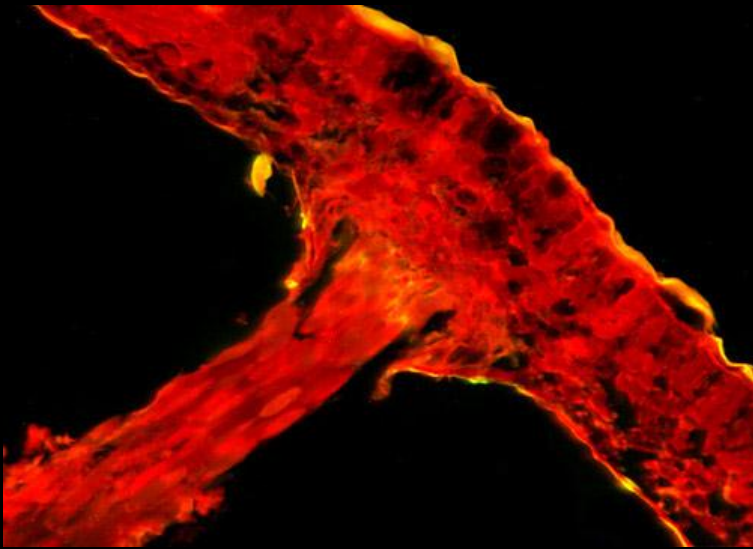
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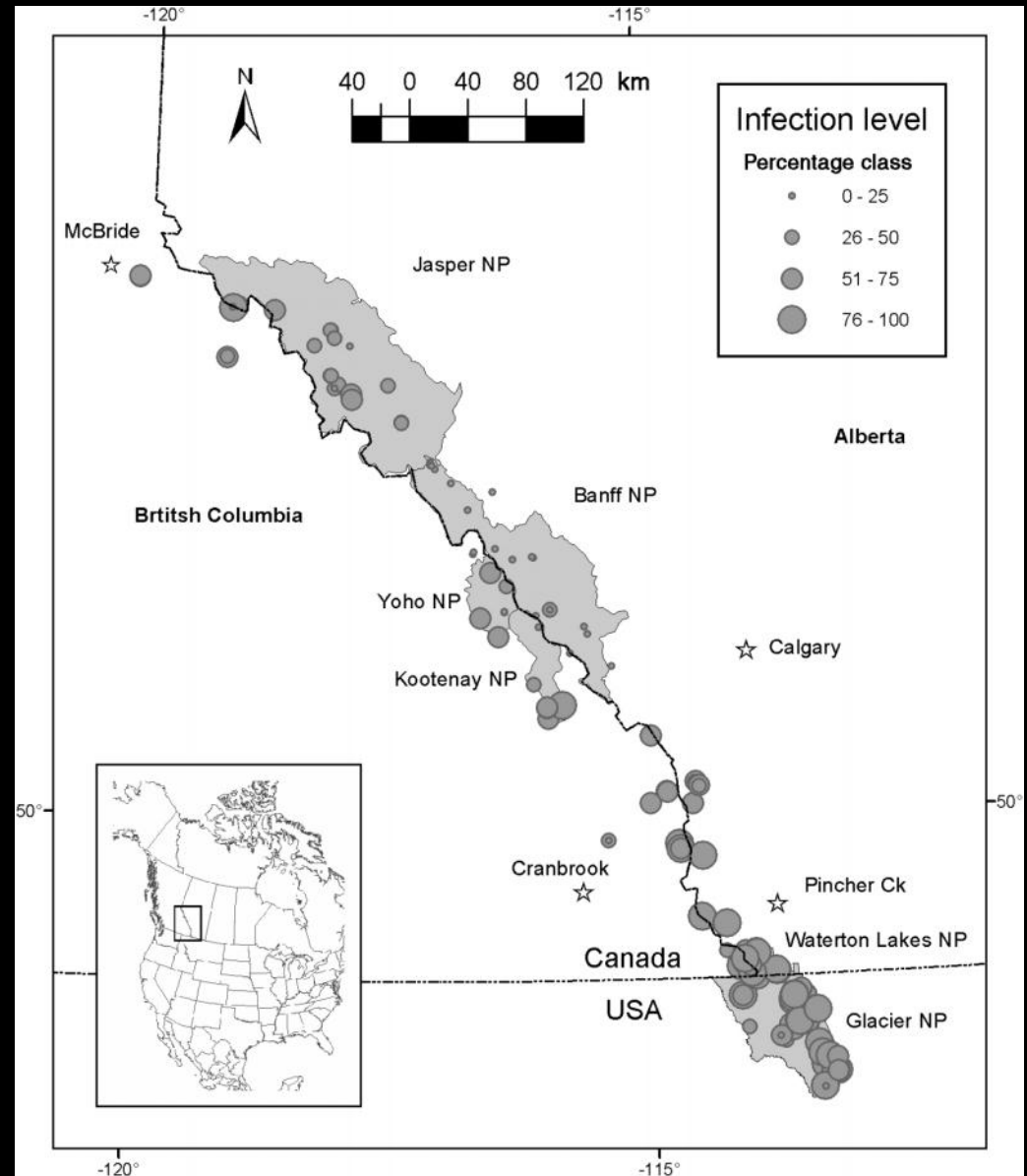
White Pine Blister Rust (*Cronartium ribicola* Fisher)



White Pine Blister Rust in Alberta

Stand level infection can be 100%

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



Recent history of mountain mine beetle in whitebark pine



Status



- Listed as endangered in AB

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- Procedures to list WBP in USA under Endangered Species Act in motion, but are moving slowly

Objective

Determine the quality of whitebark pine as a host for the mountain pine beetle (MPB) relative to lodgepole pine in terms of:

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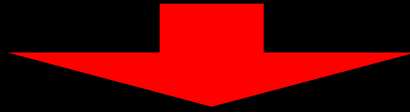


Management Recommendations

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Management Recommendations

Do we need to change our MPB strategy when stands contain whitebark pine and if so how?

What we expected to find

South of the border

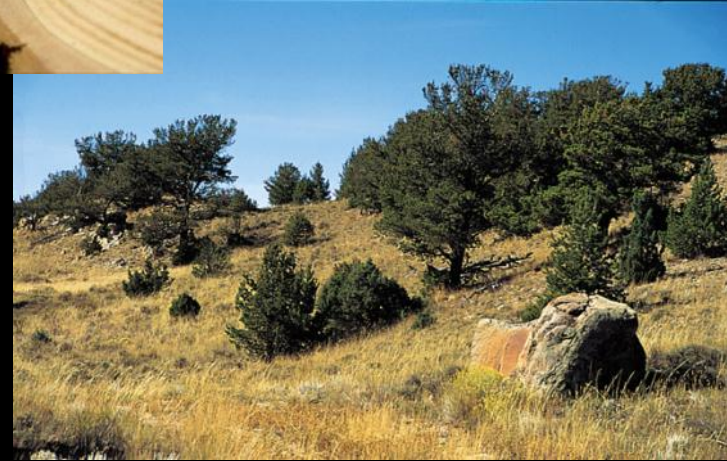


What we expected to find

South of the border



Limber pine



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Limber pine



ASRD forest health officers



What we expected to find

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Library



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Library

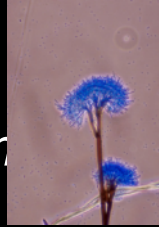


Exp.1: Fungal symbionts

Grosmannia clavigera



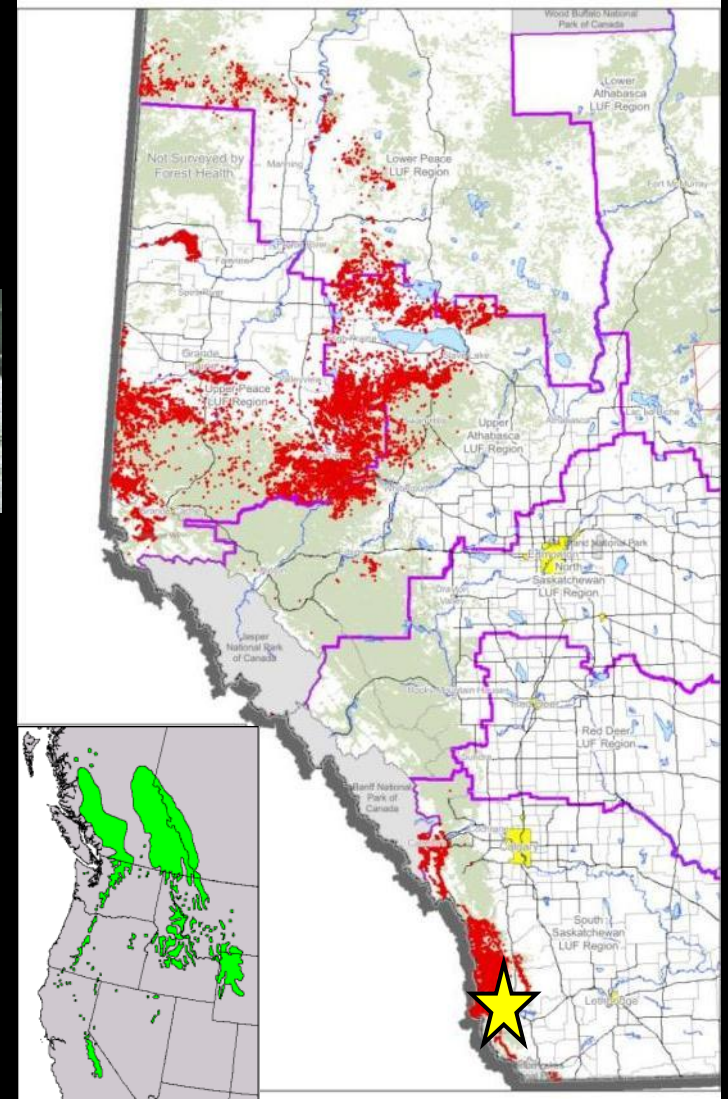
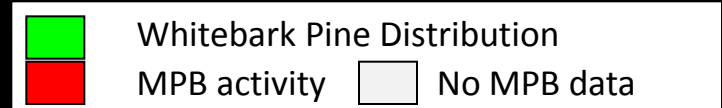
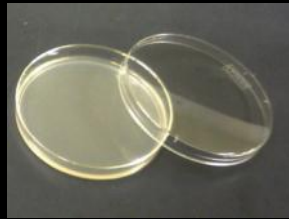
Leptographium longiclavatum



Ophiostoma montium

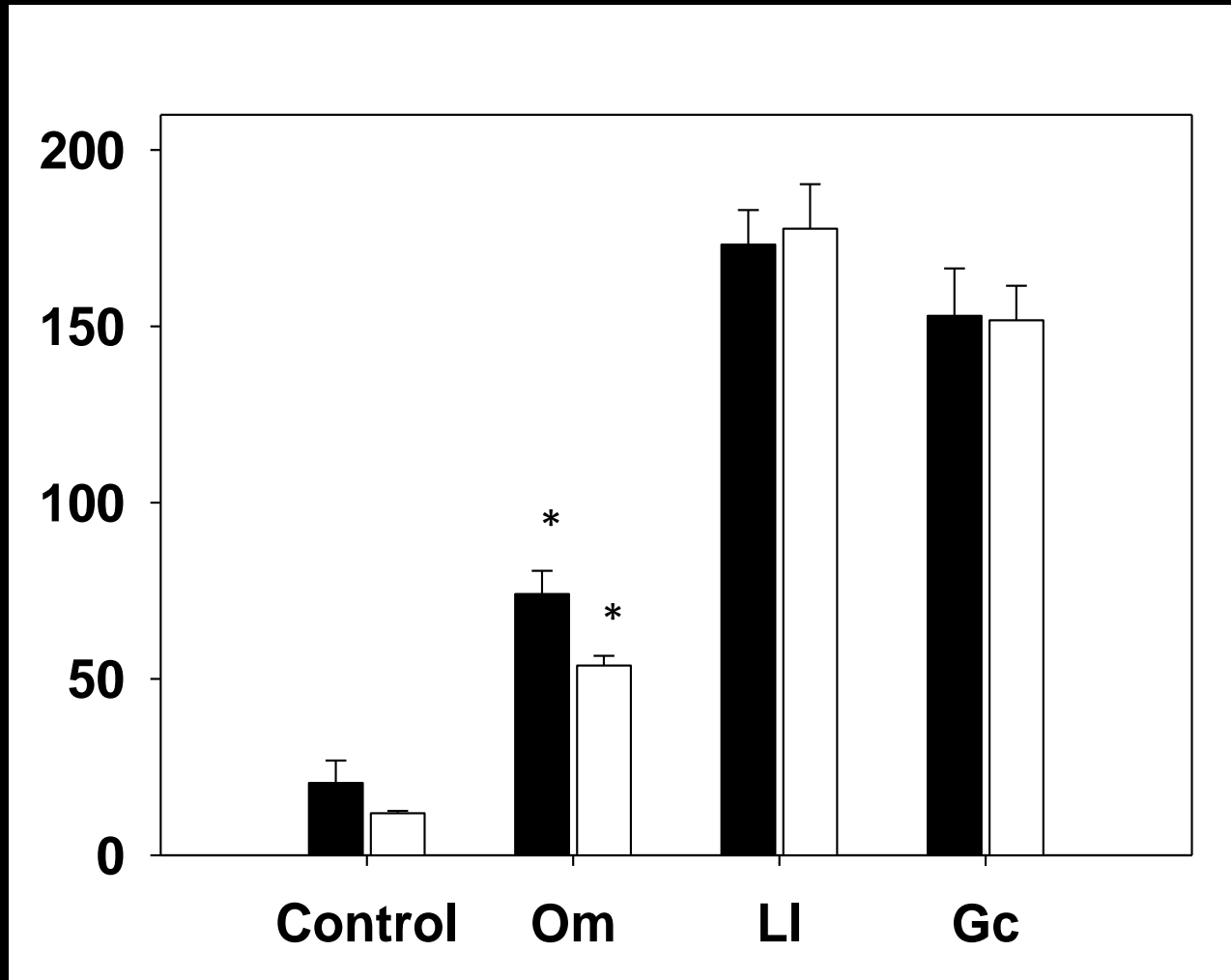
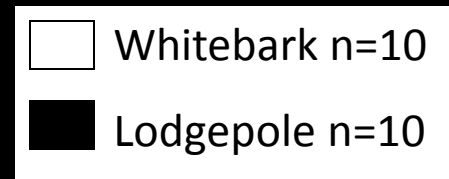


Agar control



Lesion Length

Lesion length (mm) + SE



Inoculum

Conclusions

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- WBP may have a slightly stronger induced defense response, though this is not consistent for all fungal species
- The most important fungal symbiont (*L. longiclavatum*) does well in both host species

Exp.2: Laboratory Rearing



25 Lodgepole bolts

25 Whitebark bolts

} 2 galleries initiated/bolt



Measuring MPB life-history traits

1. Gallery success
2. Brood production
3. Brood adult condition:
 - Size
 - Weight
 - Fat Content



Results

- Beetles were more likely to establish galleries in LPP than WBP



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- **Fat content was higher in beetles from LPP**

Conclusions

- Neither host species was better than the other in all measured traits

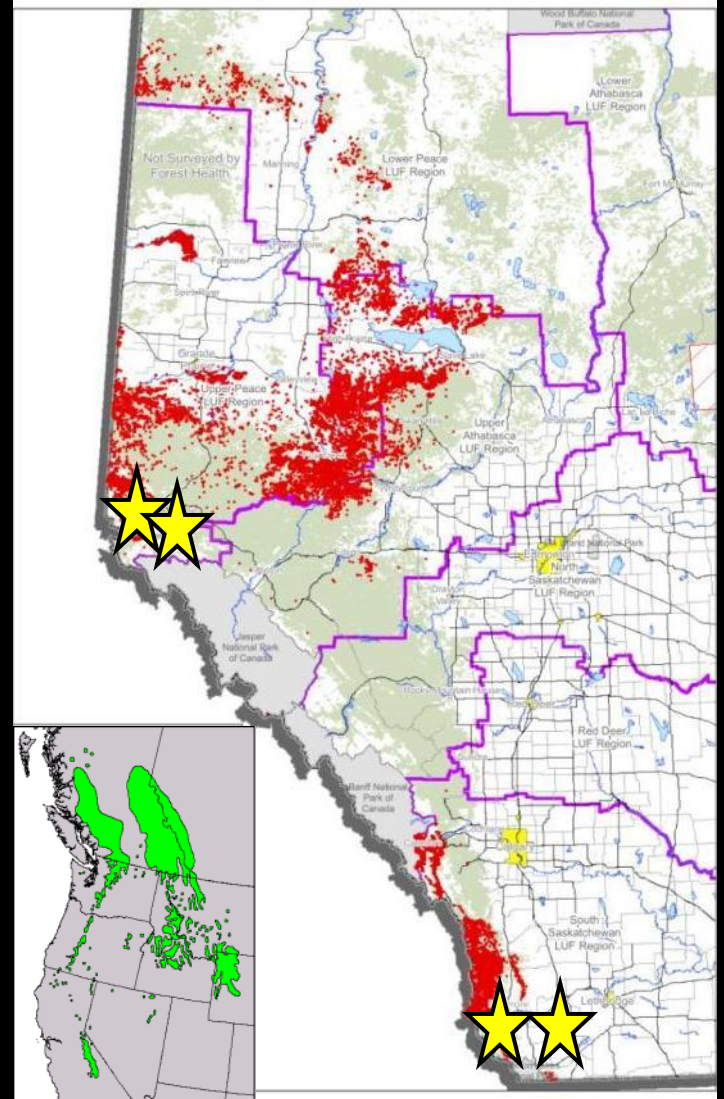
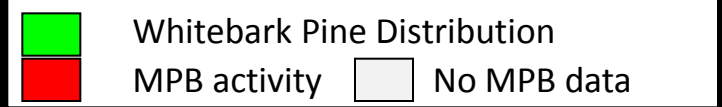
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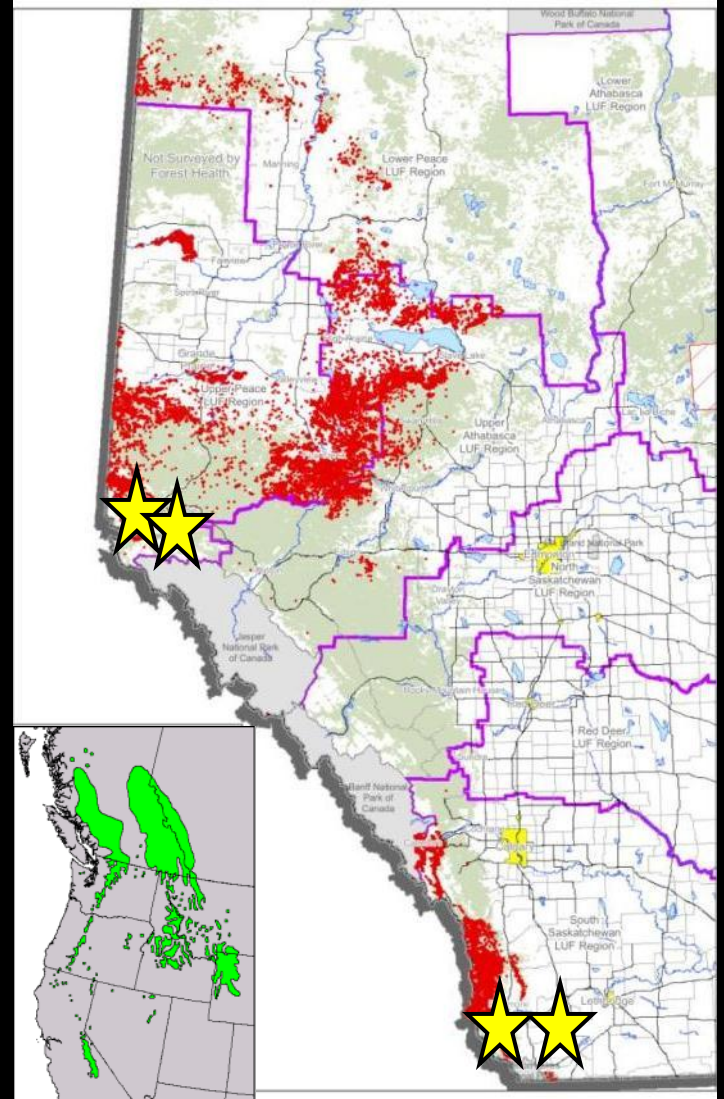
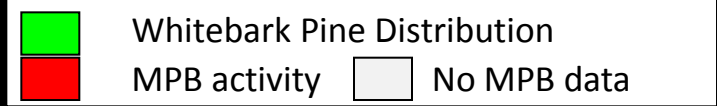
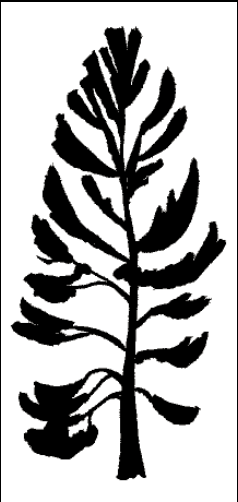
Conclusions

- Neither host species was better than the other in all measured traits
- The quality of each individual tree (i.e. phloem thickness) had a greater impact on MPB success than the identity of the host species
- Quality of WBP varied greatly with phloem thickness, more so than LPP. Only WBP bolts with thicker phloem were good host for the MPB

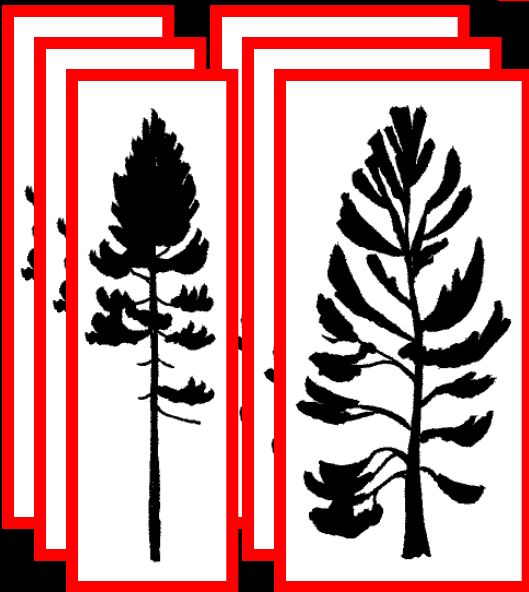
Exp.3: R_n and Phenology



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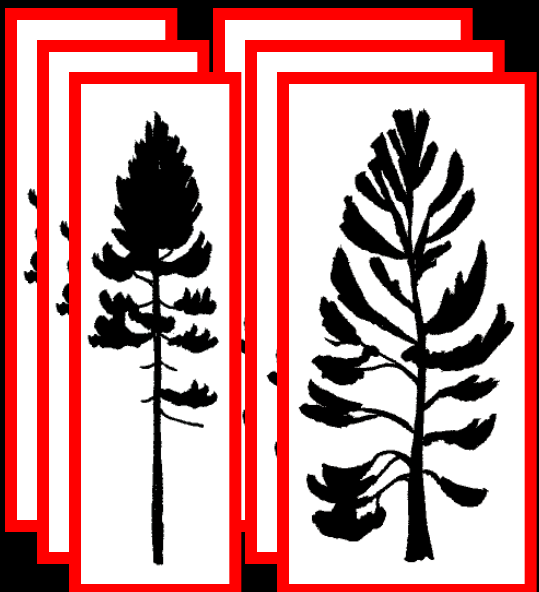


2008-2009



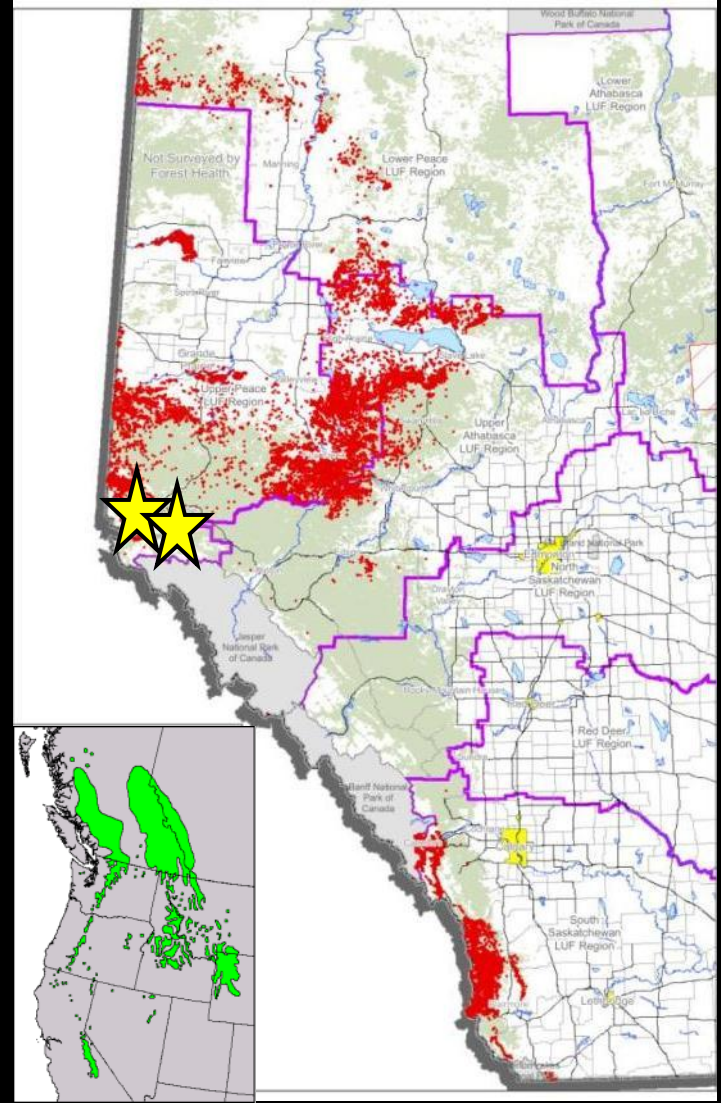
X 3

6

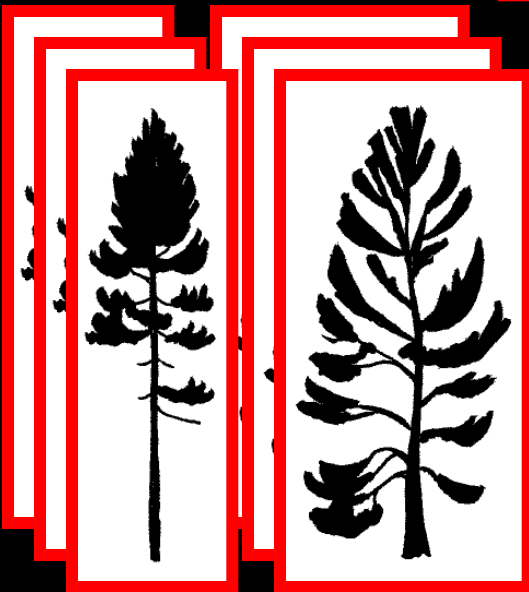


X 3

Whitebark Pine Distribution
MPB activity No MPB data



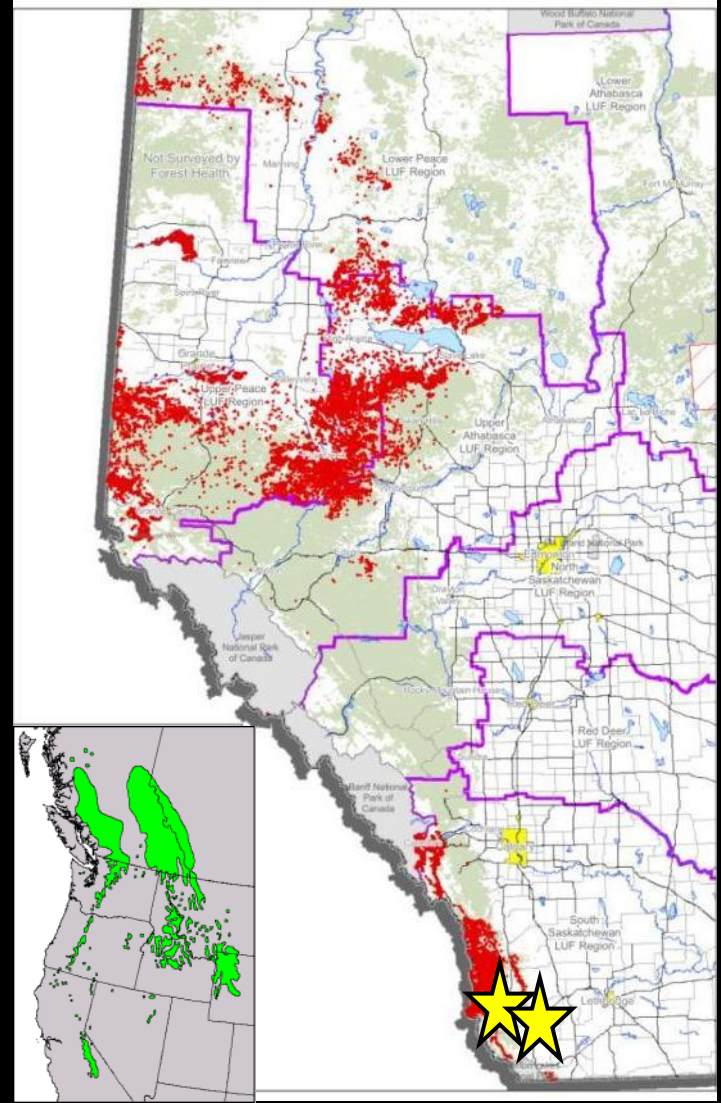
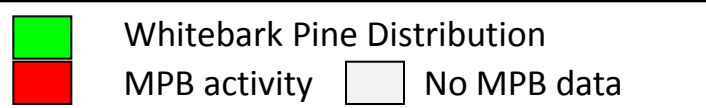
2009-2010



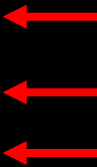
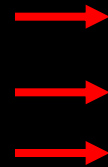
X 6

12

X 6



Exp.3: R_n and Phenology



Results

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Results

- Mortality high 2008-2009 and complete 2009-2010 in experimental stands
- Mortality of egg and larval stages were greater in greater in WBP, though did not translate into large differences in R_n
- Unlike limber pine WBP phloem was not thicker than LPP phloem
- 1/3 of brood reached adult stage by early July, 1/3 might emerge later flight in the season, and 1/3 would definitely not emerge that year

Conclusions

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- Presence of a 1 year life cycle at upper latitudes and elevations is outside the historical envelope for the MPB and will likely mean more MPB in the near and distant future

Synthesis

Synthesis

South of the border



Synthesis

South of the border



South of the border

Synthesis

J. Logan



D. Six



South of the border

Synthesis

B. Bentz



Synthesis

B. Bentz



Constitutive defenses:

$$WBP > LPP$$

Induced defenses:

$$WBP < LPP$$

Net Reproductive Rate

$$WBP < LPP$$

Local Sages

Synthesis

Synthesis

Local Sages



Synthesis

Local Sages



squillion

X10

Conclusions

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Conclusions

- The quality of WBP as a host for the MPB varies geographically
- There was NOT strong evidence that host species was the most important factor in determining host quality for the MPB, instead quality of a given tree was more important (i.e. Phloem thickness)
- We are confident that WBP does not have thicker phloem than a LPP of similar DBH

Conclusions continued

- WBP's with thick phloem were excellent hosts for the MPB and were better than LPP with thick phloem in some but not all regards

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- WBP's with thick phloem were excellent hosts for the MPB and were better than LPP with thick phloem in some but not all regards
- In years prior to my study in northern AB immigrant beetles were able to locate the highest quality WBP's and did exceptionally well. The presence of decadent, mature WBP in a stand may encourage establishment of MPB populations

Conclusions continued

- Favorable climate has expanded the envelope of univoltinism to new latitudes and elevations. This will likely mean more WBP mortality in near and distant future. However, MPB will still have to overcome high mortality rates in these areas to grow.

Acknowledgements

- D. W. Langor, J.R. Spence, & N. Erbilgin
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- Joyce Gould @ Parks



Natural Resources
Canada

