MPB, fuel loadings, and loss of forest resilience?

Lotan, J. (1976). Cone serotiny - fire relationships in lodgepole pine. In: Tall Timbers Fire Ecology Conference Proceedings 14, Tall Timbers Research Center, Tallahassee, FL. pp. 267-278

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Endemic vs. post-outbreak (20-25 years)

- Ashley NF, Utah

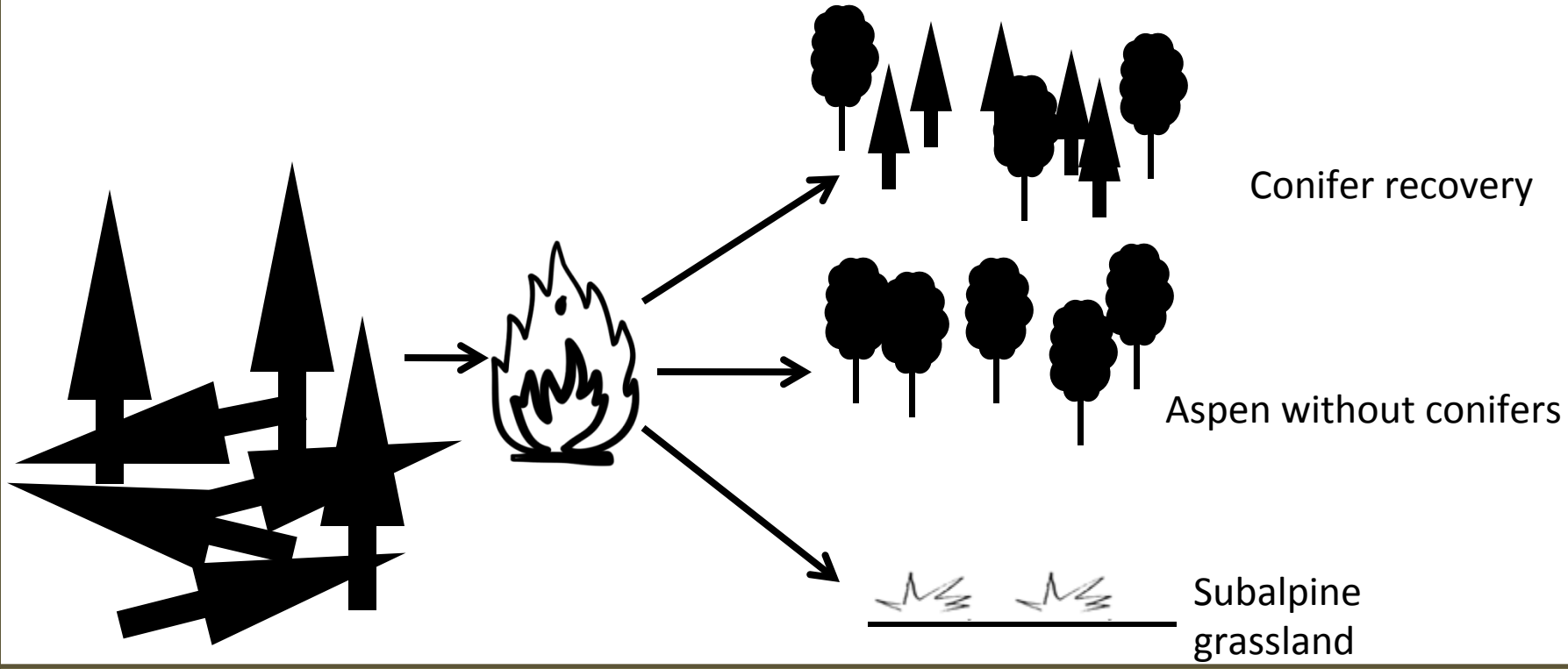
Endemic

Post-Epidemic

from Page and Jenkins 2007

MPB-associated fuels down the road…

- What does this mean for subalpine forest resilience to fire?



Potential consequences

Loss of resilience to fire

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Lack of coniferous recovery post-fire

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Potential conversion to aspen-only stands or subalpine grasslands

↓

Corresponding changes in snowpack behavior and water issues

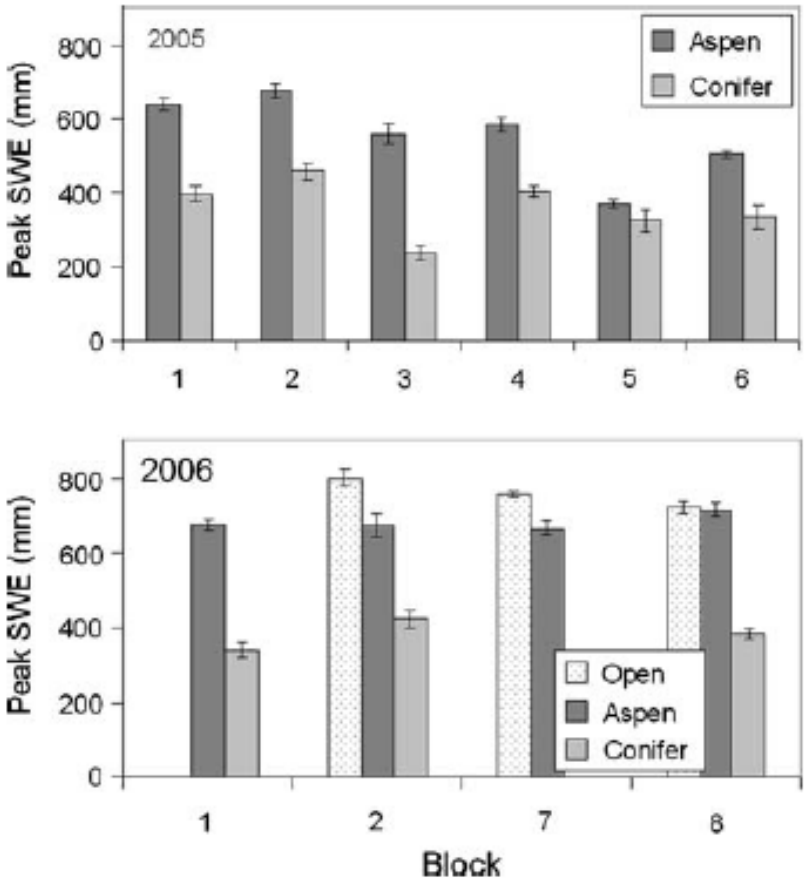

Figure 2. Peak snow water equivalent (SWE) collected in paired aspen and conifer stands in 2005 and 2006. Two meadow sites (*Open*) were also measured in 2006. Error bars represent 1 SE.

LaMalfa and Ryle 2008, Utah

MPB-associated fuels down the road…

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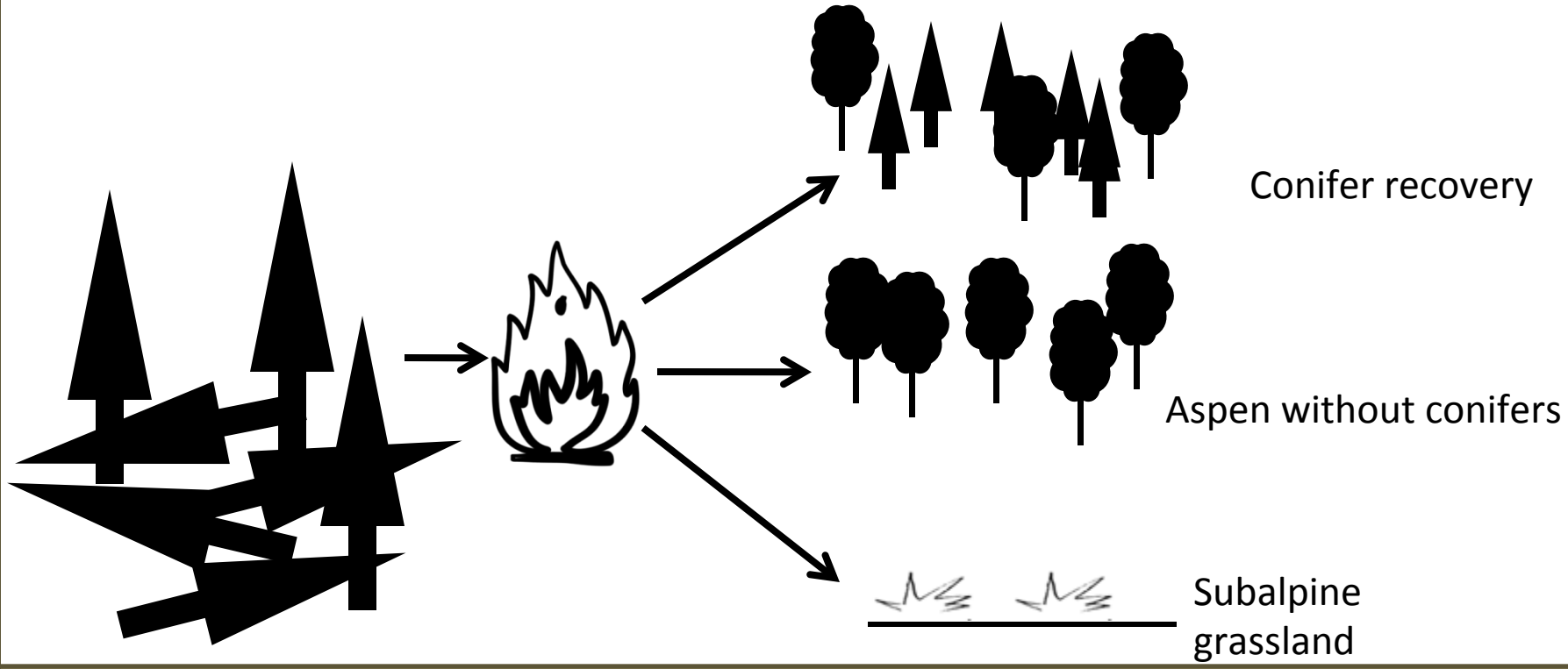


Beetles / Blowdown

20-25 years post beetle, photo from Page and Jenkins 2007

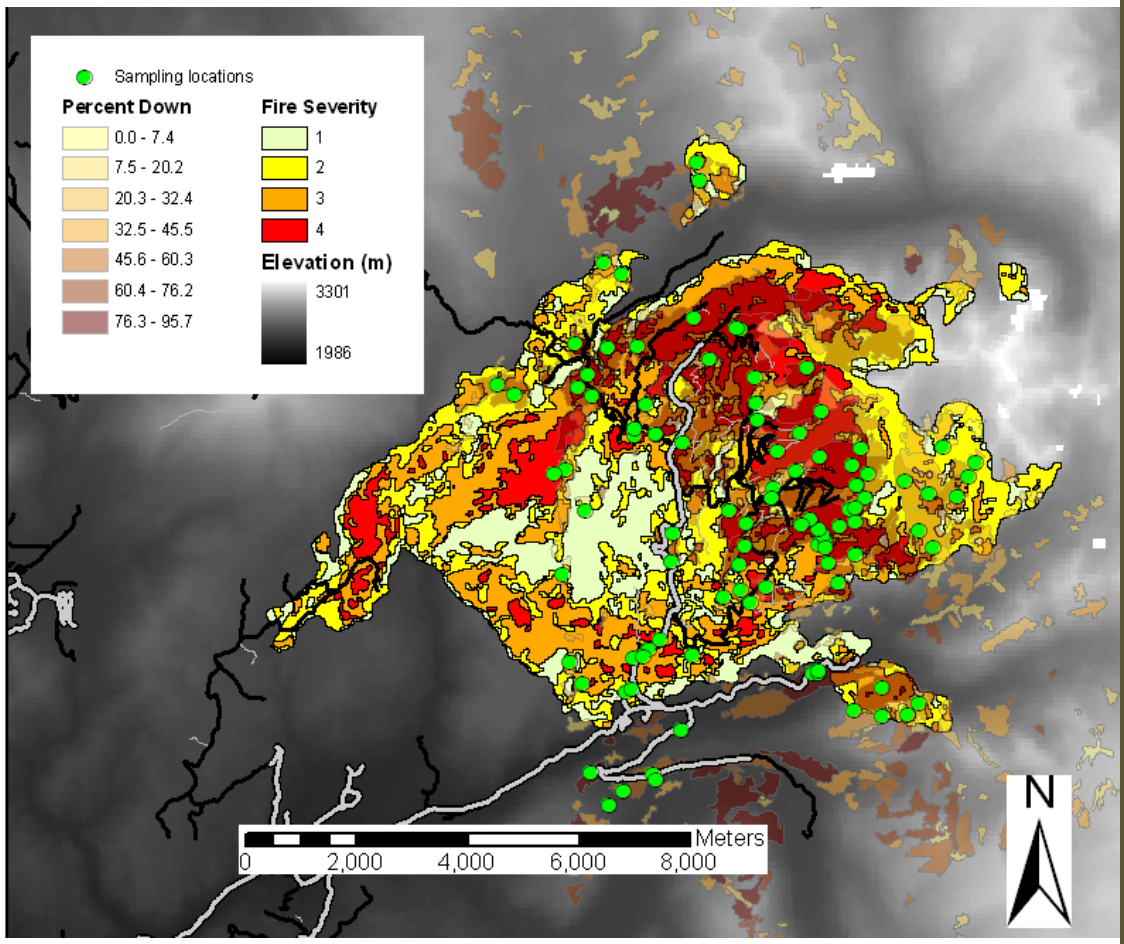
Post-blowdown, photo courtesy of Carol Wessman

Routt NF blowdown/logging/fire

- Blowdown 1997
- Salvage logging 1998-2001
- Hinman fire 2002

Variable severities of blowdown, simulating various levels of MPB infestation

(in terms of fuel load behavior and post-fire recovery)

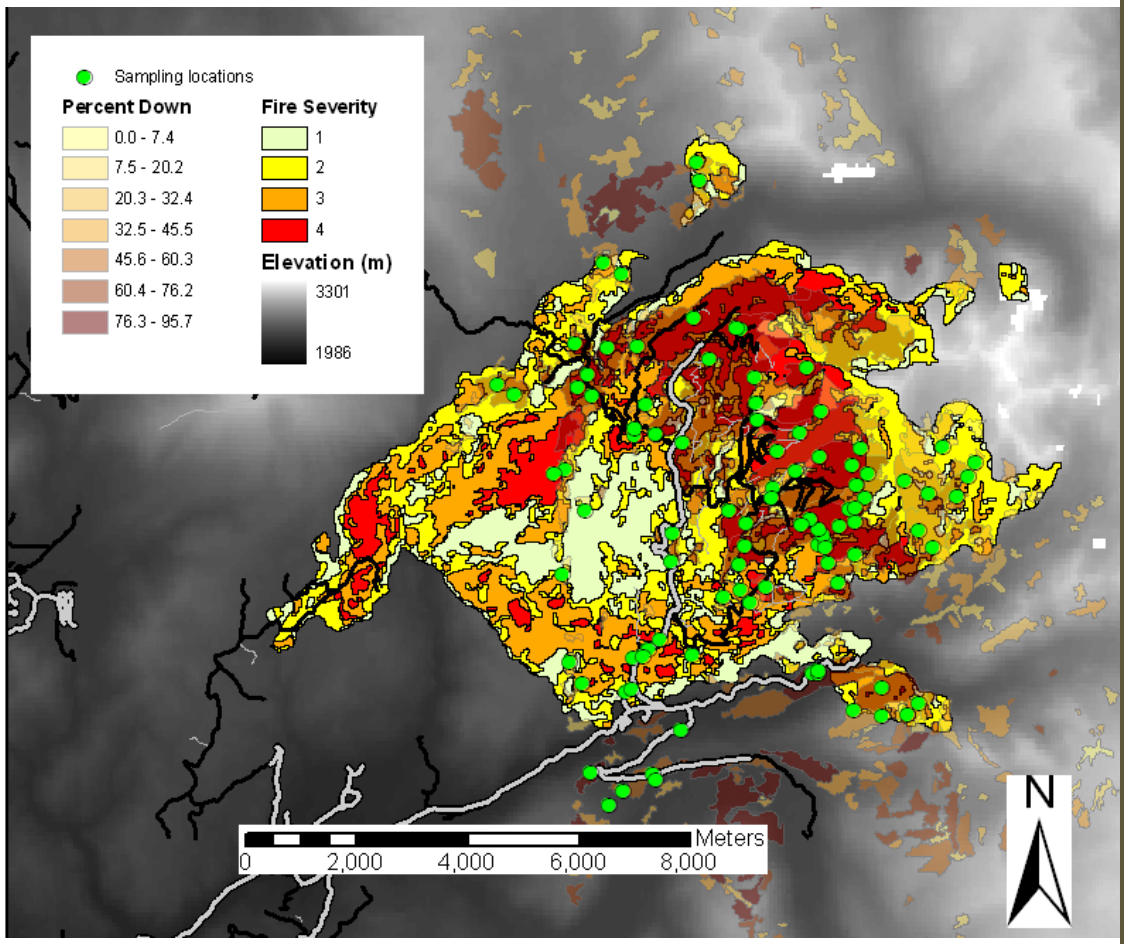


Questions

- Do abnormally high fuel loads impact post-fire subalpine conifer recovery?
- Do MPB stands reach fuel loads which might affect coniferous forest resilience?

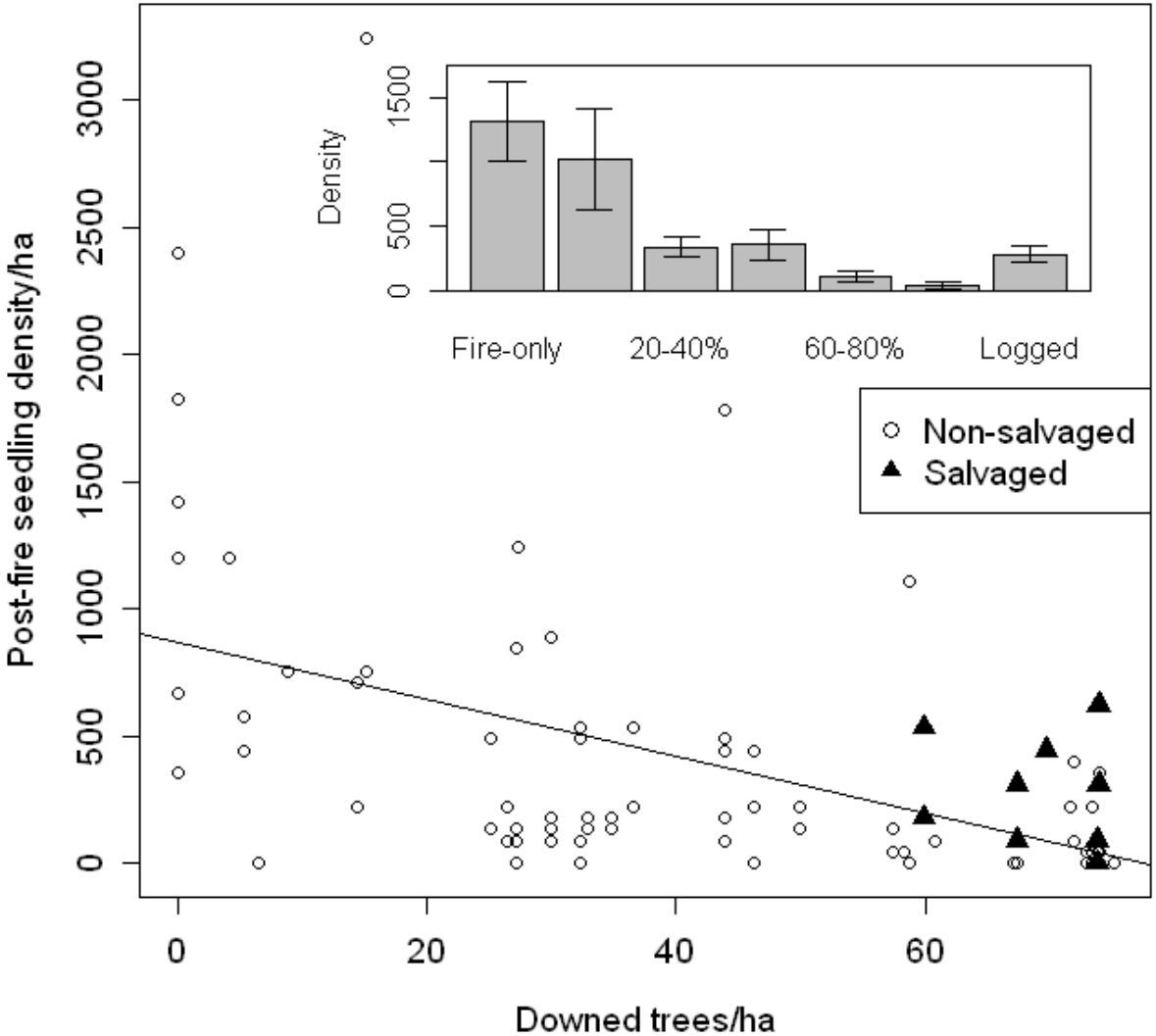
Field methods (Routt)

- 99 sites
  - 15x15 meter plots
  - All mixed subalpine prior to fire
  - No aspen
- Variable fuel loading pre-fire



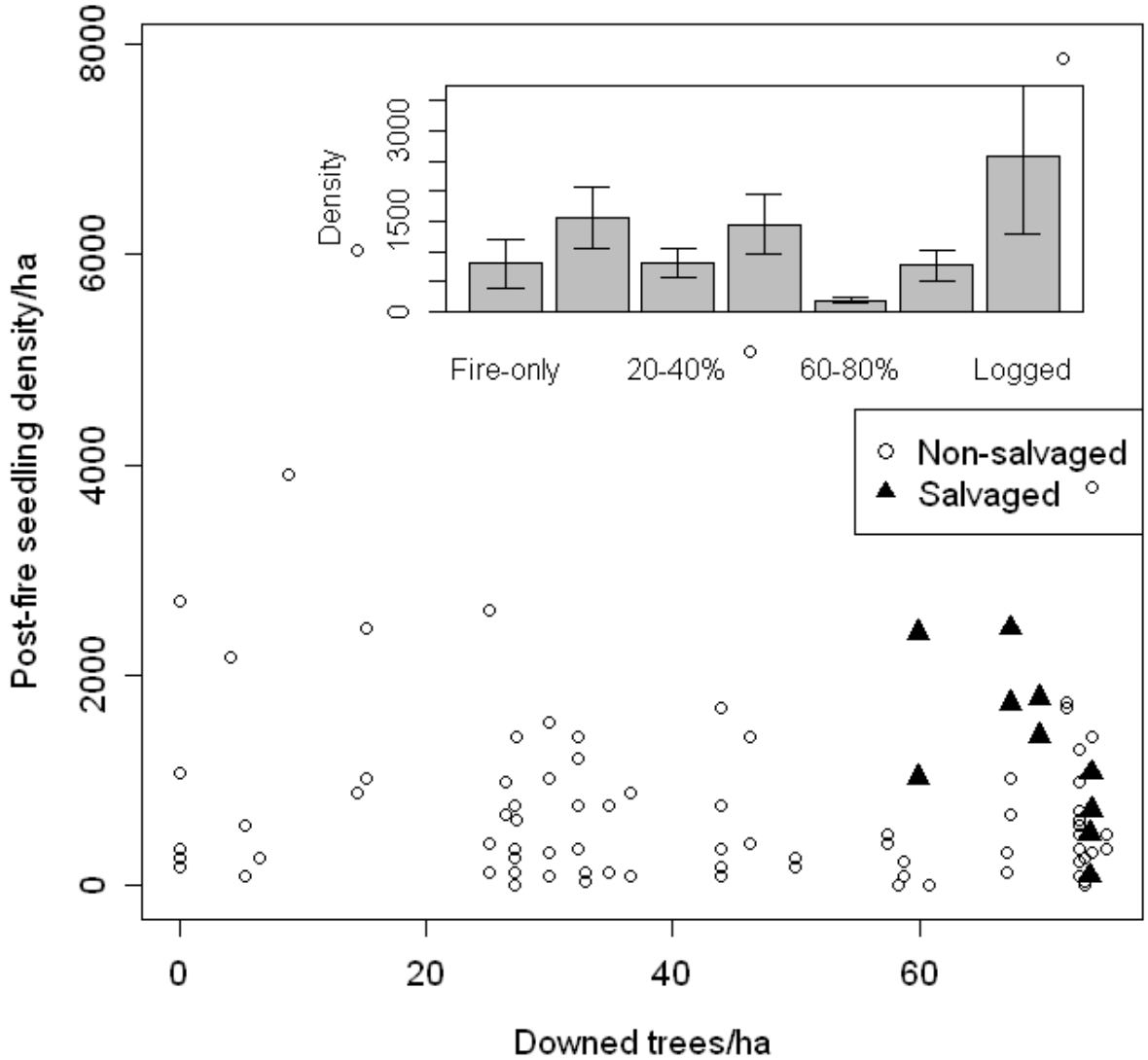
Post-fire conifer recovery (8 years)

- Little recovery seen when large amounts of CWD were present pre-fire
- Stronger recovery at low CWD levels



Post-fire aspen establishment (8 years)

- Aspen densities basically independent of fuel loading
- No sites had mature aspen pre-fire



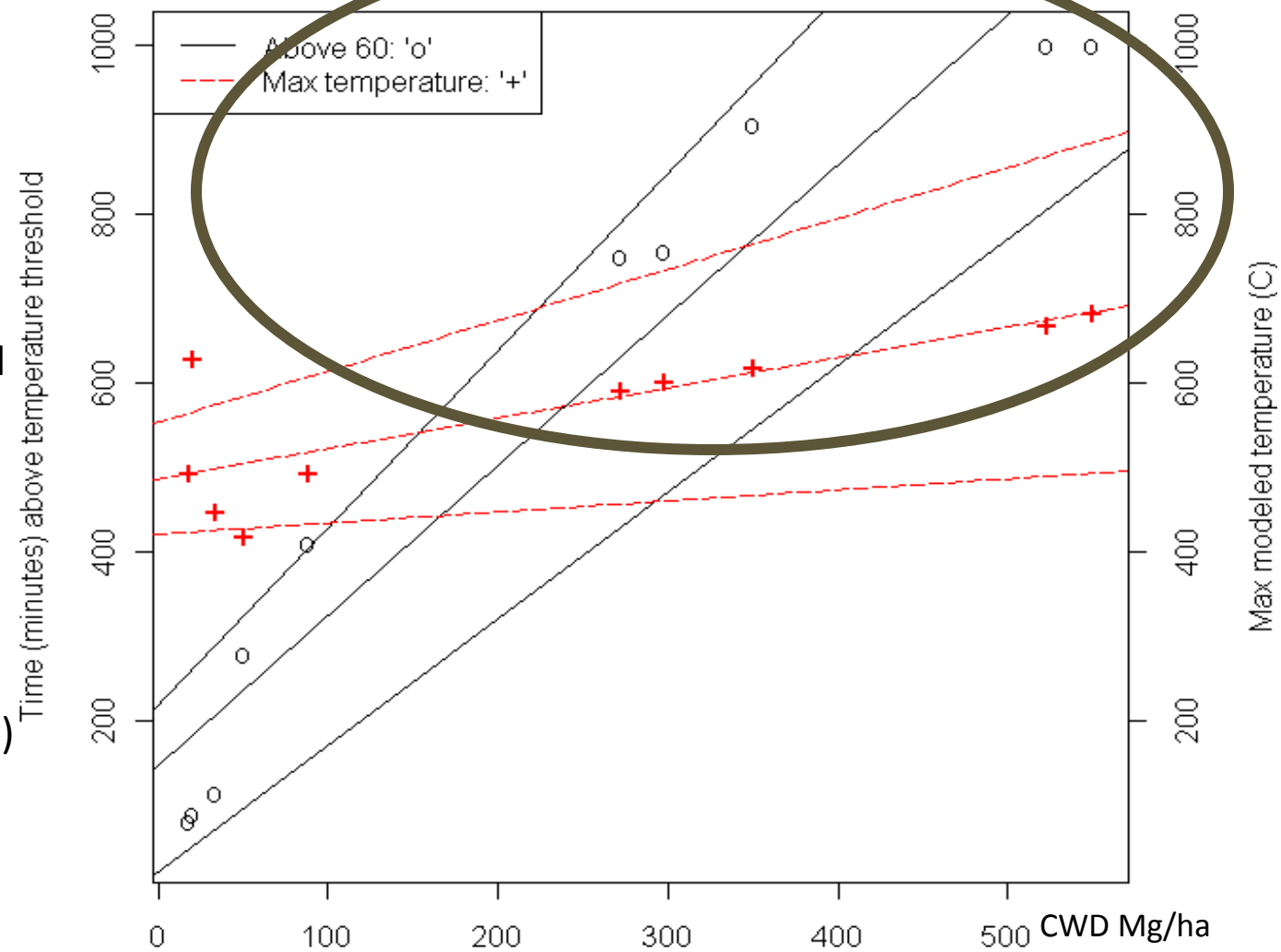
Modeled fuel load effects

Loss of a conifer load presence?

Longer lived / hotter fires consuming serotinous cones

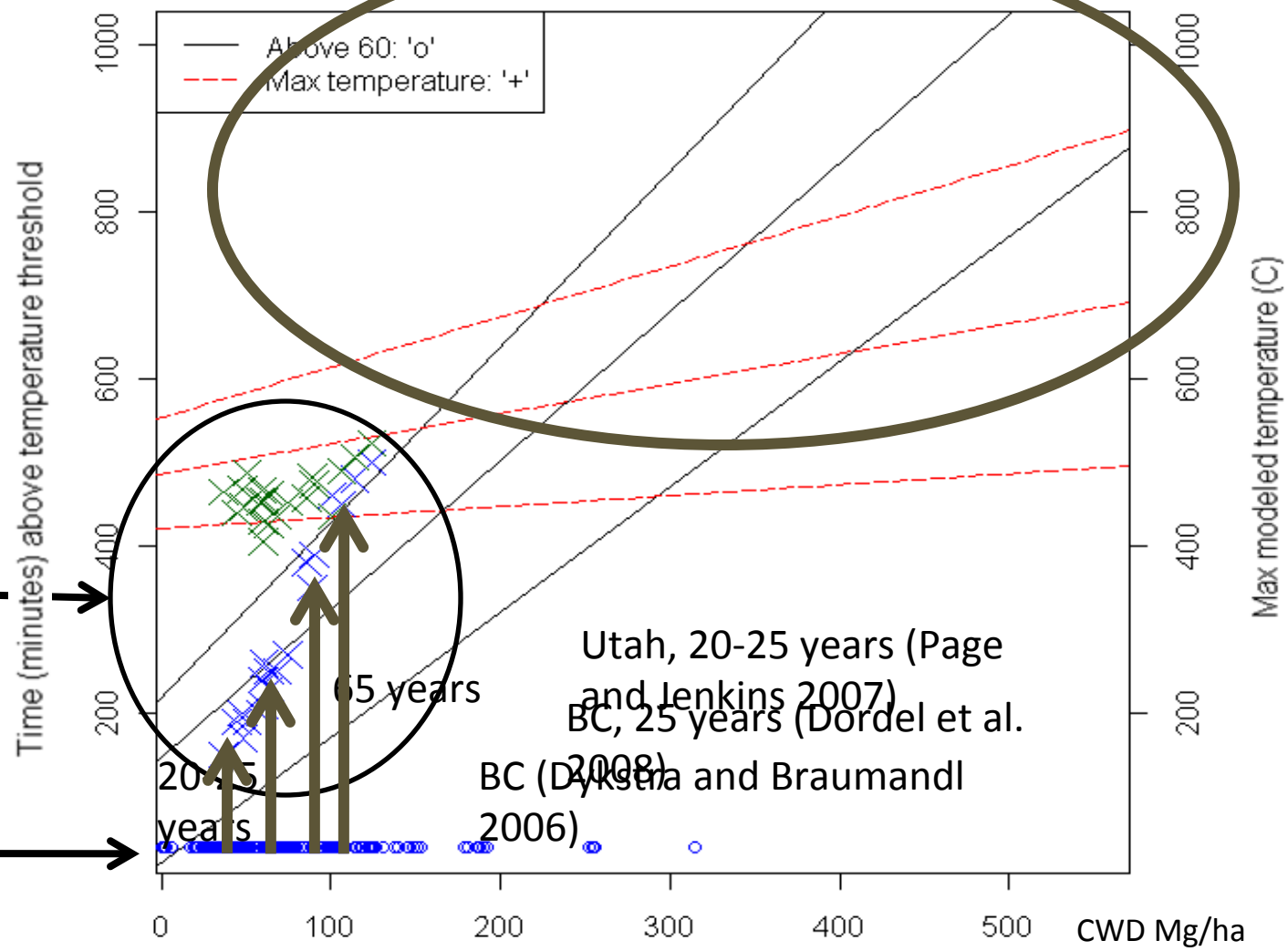
Aspen invasion via seed dispersal independent of fire characteristics

Spruce-fir seed dispersal is distance limited (small component of recovery)



Where do MPB fuel loads stand?

Modeled burn times approaching levels associated with little regeneration in blowdown-fire system



Stand means
Blue- time
Green- max temp

Plot level loading

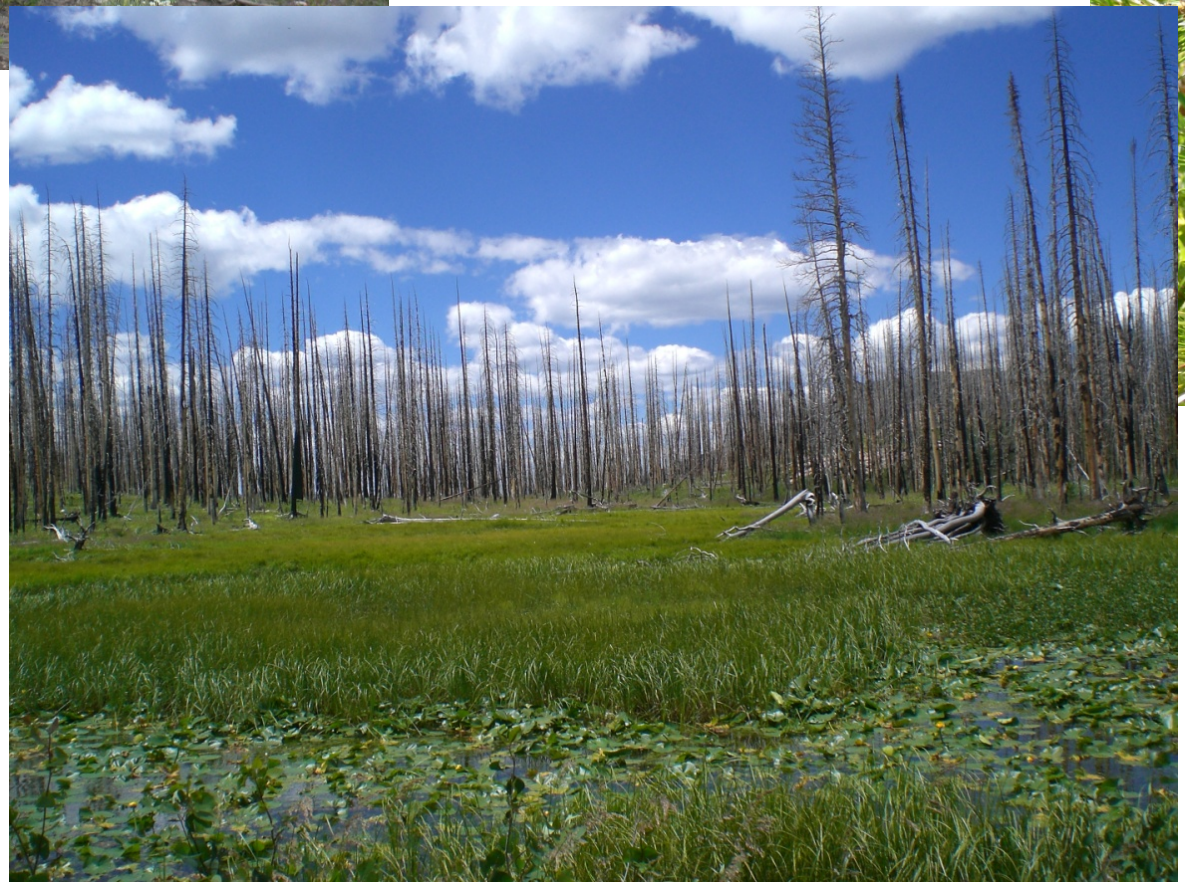
Conclusions

- High fuel loading can reduce conifer forest resilience to fire
- MPB-associated fuel loadings at stand scale below levels which eliminated conifers in Routt
- Distribution of high fuel loads heterogeneous
- Standard succession (e.g. aspen + conifer to conifer) likely

Water take-home

- Changes to aspen or grasslands possible under higher fuel loads, lower fuel load forests quite resilient
  - Increases in water yield, peak flow issues?
    - Melt out rate similar despite diff. in peak SWE.
  - Aspen 42-83% greater potential water yield
- Conifer recovery (and similar water dynamics) likely long-term
- Short-term "standard successional" water dynamics (mixed stands)
- Landscape cover-types more heterogeneous

Questions? Thoughts?

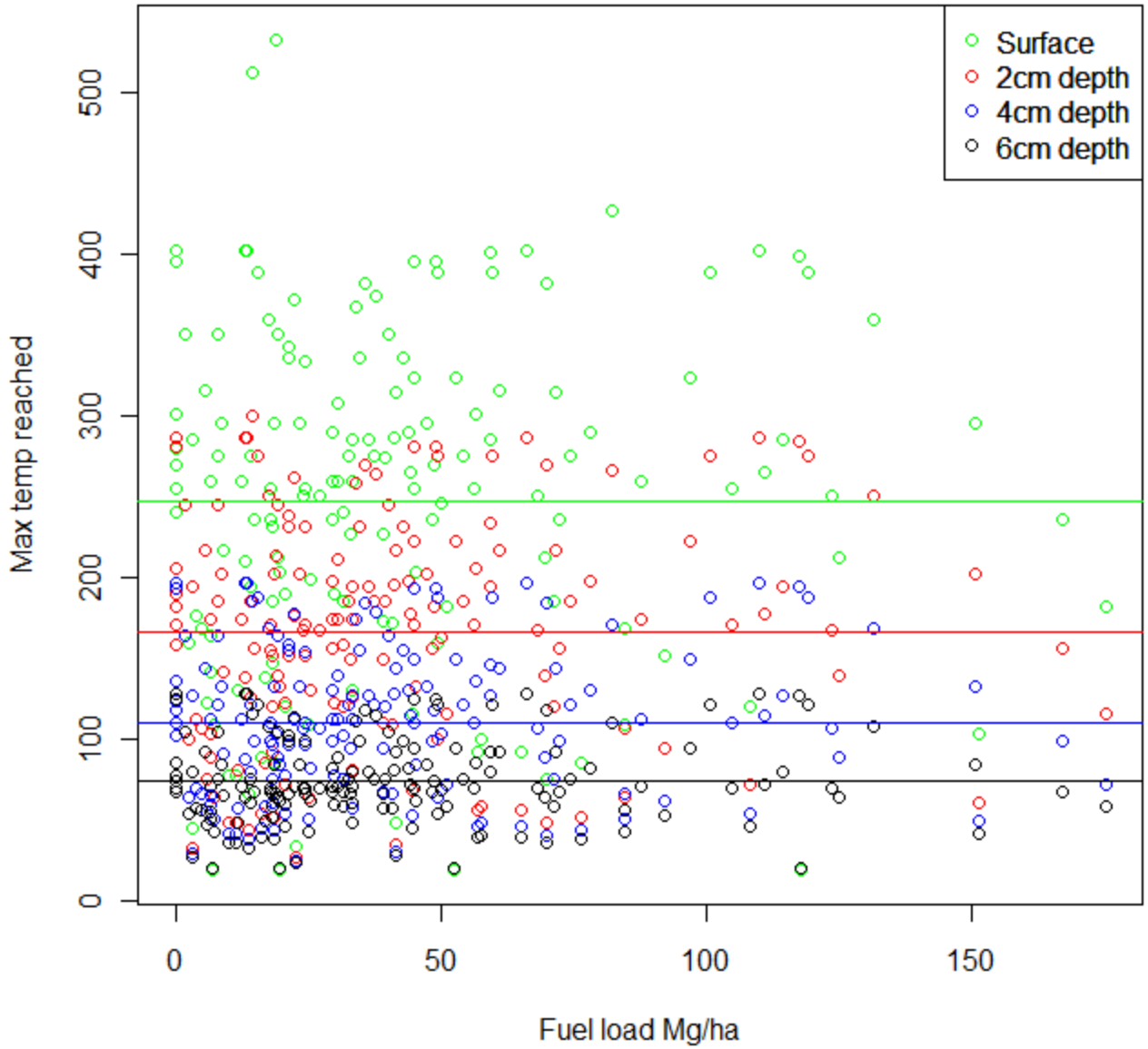


- Thanks- Carol Wessman, CU EBIO Dept and CIRES, various folk for field help

Other considerations

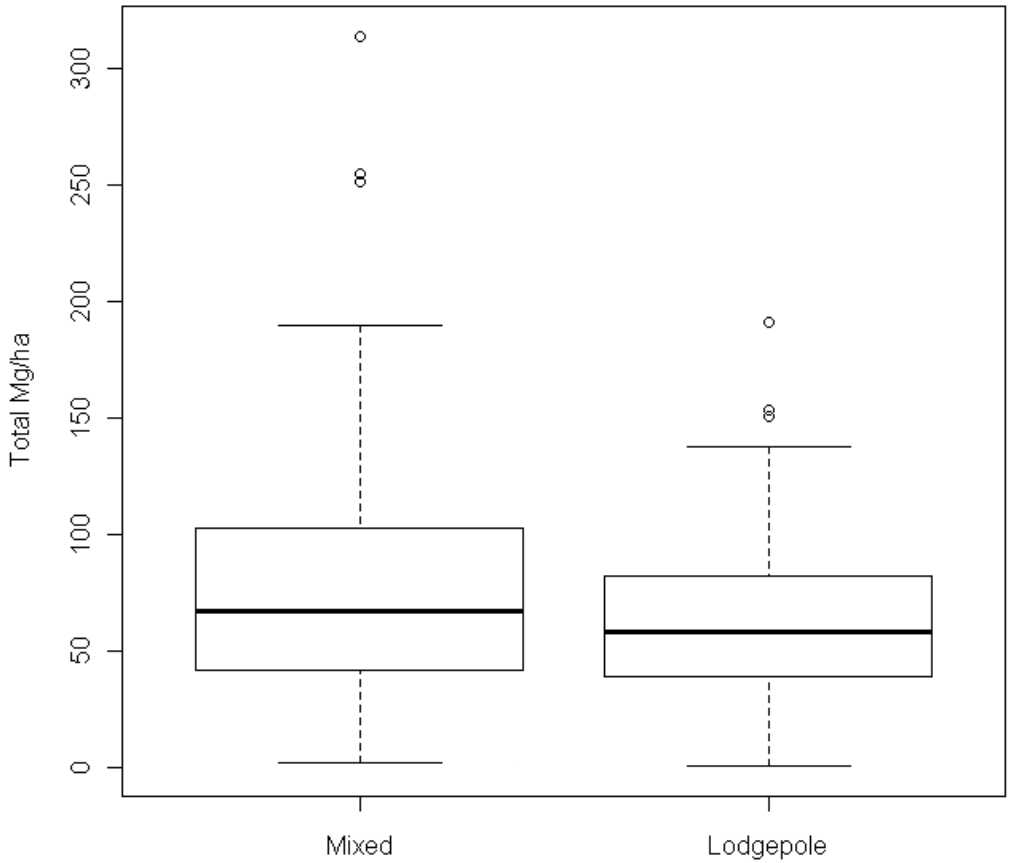
- Stand composition variables
- Stand recovery variables (e.g. canopy height, volume, etc)
- Climate change impact on regeneration success and precip.
- Serotiny in recovering LP forests?
- Erosion?

Soil heating profiles for Pelz MPB plots



MPB 30 years post-outbreak

- Pelz data



References

- Hawkes et al. 2004. Impact of Mountain Pine Beetle on Stand Dynamics in British Columbia In Mountain Pine Beetle Symposium: Challenges and Solutions. October 30-31, 2003, Kelowna, British Columbia. T.L. Shore, J.E. Brooks, and J.E. Stone (editors). Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Information Report BC-X-399, Victoria, BC. 298 p.
- Page, W. and Jenkins, M. (2007). Mountain pine beetle-induced changes to selected lodgepole pine fuel complexes within the Intermountain Region. Forest Science, 53(4): 507-518.