Silvicultural experiments exploring linkages between stand structural diversity and ecological variables in California

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Outline

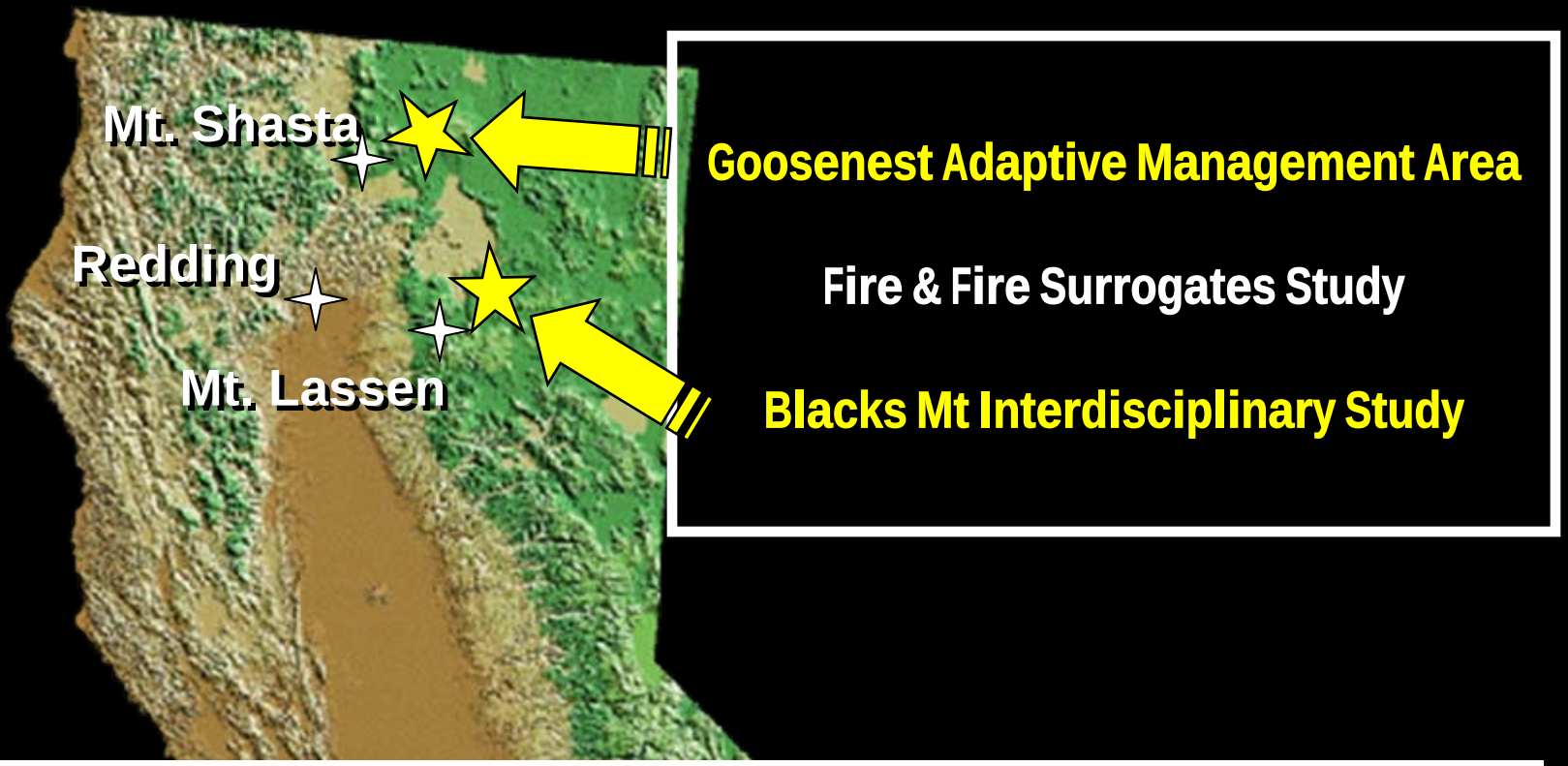
- **Blacks Mountain Interdisciplinary Ecological Study**

  Ecological effects of stand structural complexity

- **Goosenest Adaptive Management Area Study**

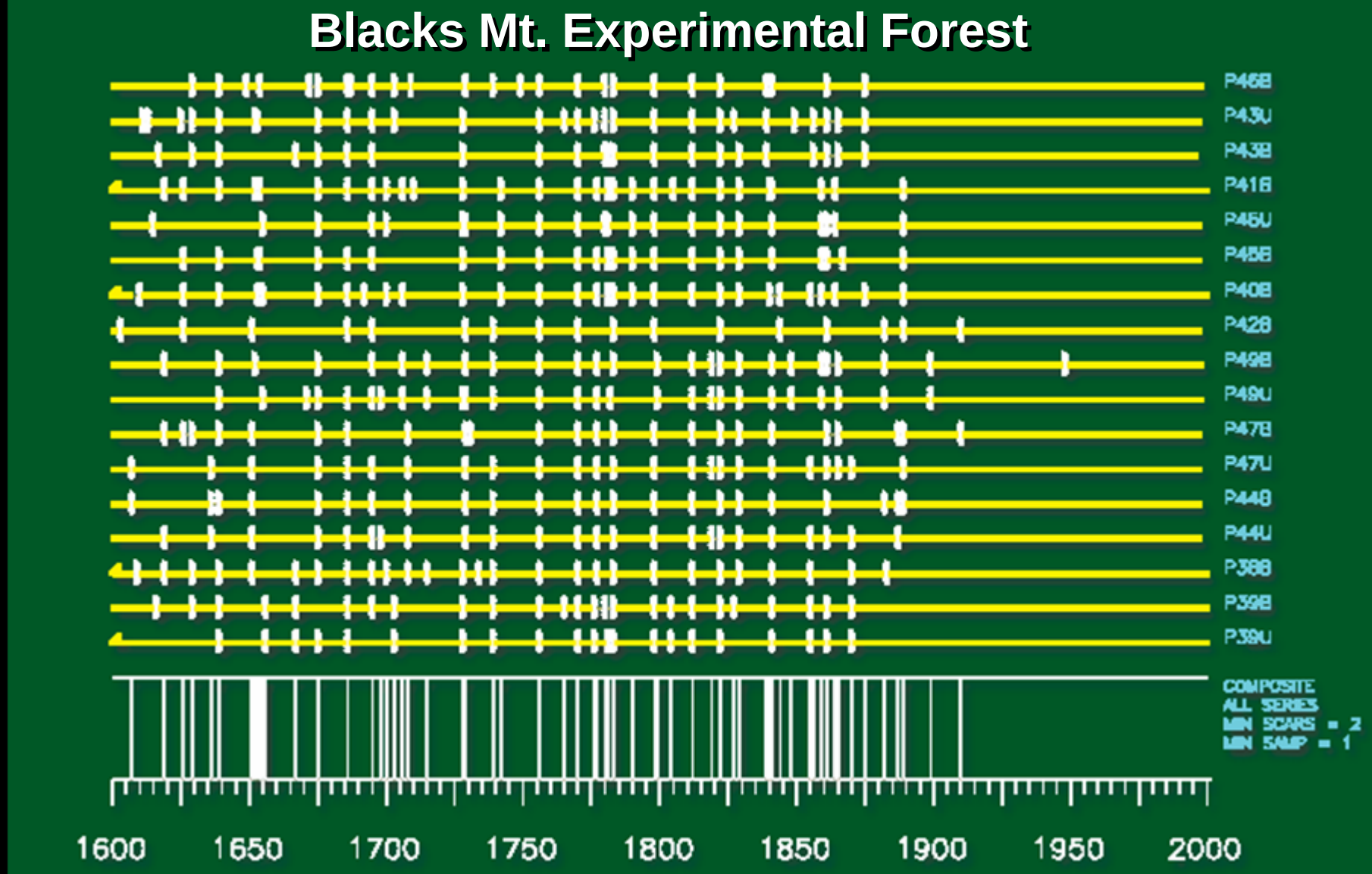
  Ecological effects of treatments designed to accelerate growth of large trees

  Ecological effects of treatments for reducing fire hazard - FFS



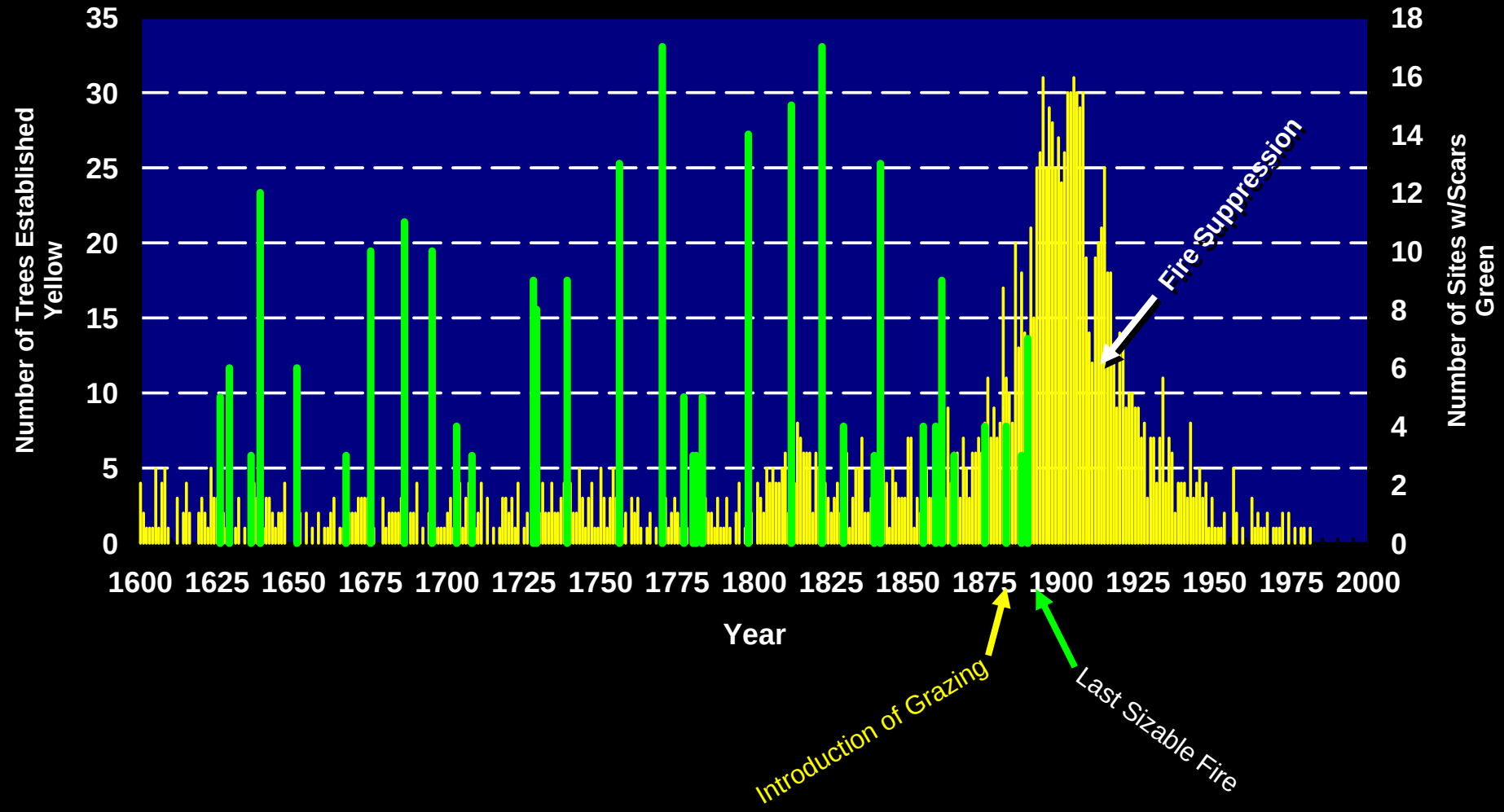
- Fire Regime: Frequent Fires of Low Intensity
- Large interdisciplinary studies of reducing fire hazard and restoring or maintaining old forest conditions through silvicultural treatments.
- Approximately 6000 acres of treatments.

Fire History



Fire Occurrence & Tree Establishment

Blacks Mountain Experimental Forest



Stand Structure & Species Composition

Changes over 20th Century

Original Stand Structure

Fire exclusion has helped lead to increasing stand density.

Blacks Mountain study

Objective: understand ecological ramifications of within-stand structural complexity

High diversity

~ 10-15% of stand untreated,
~ 10-15% in 0.25-2ac gaps,
~ thin from below - large trees retained

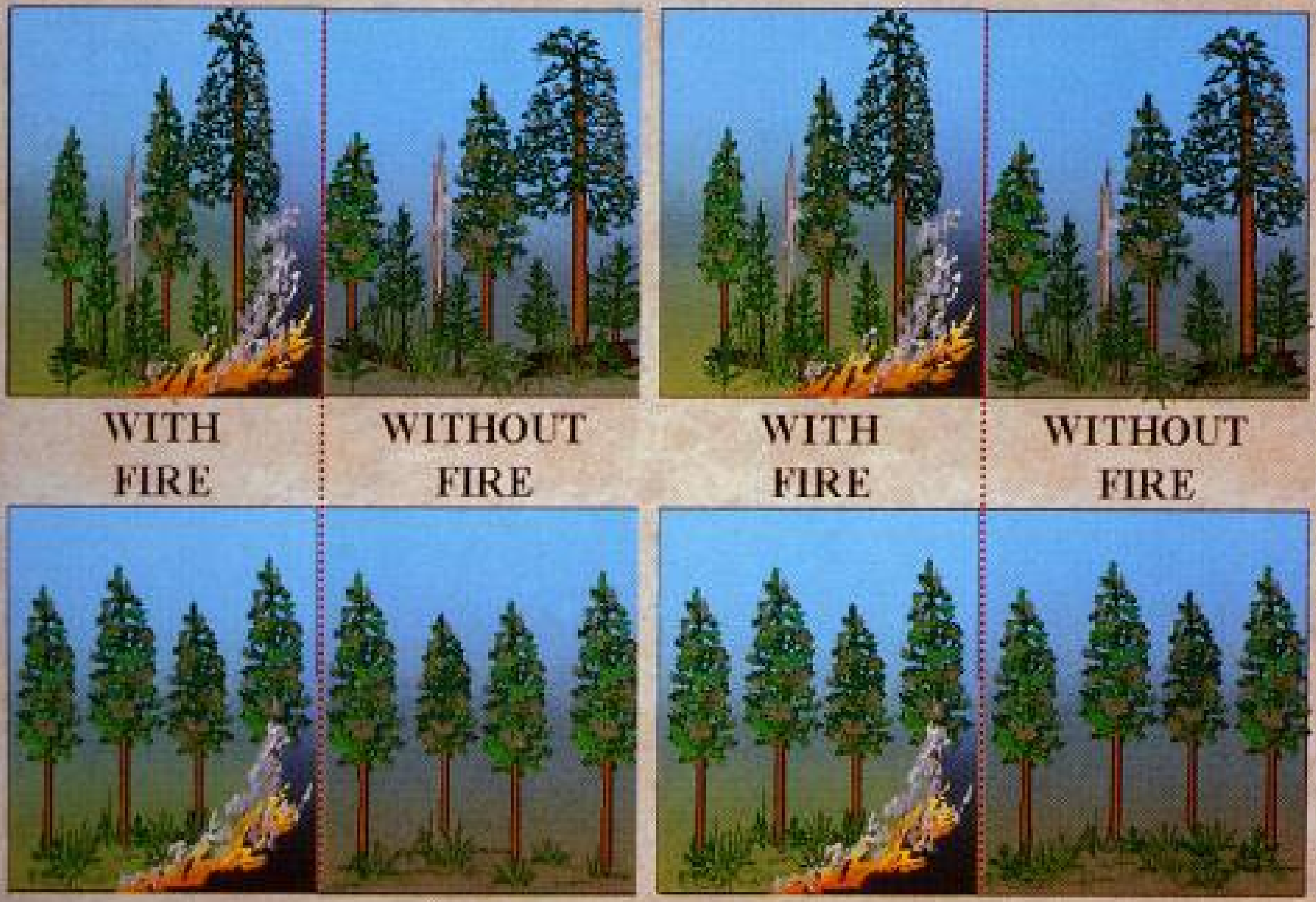
Low diversity

large trees removed,
intermediates evenly spaced

HIGH STRUCTURAL DIVERSITY

GRAZING

NO GRAZING



LOW STRUCTURAL DIVERSITY

Untreated RNA

1yr Post Rxfire

4yrs Post Rxfire

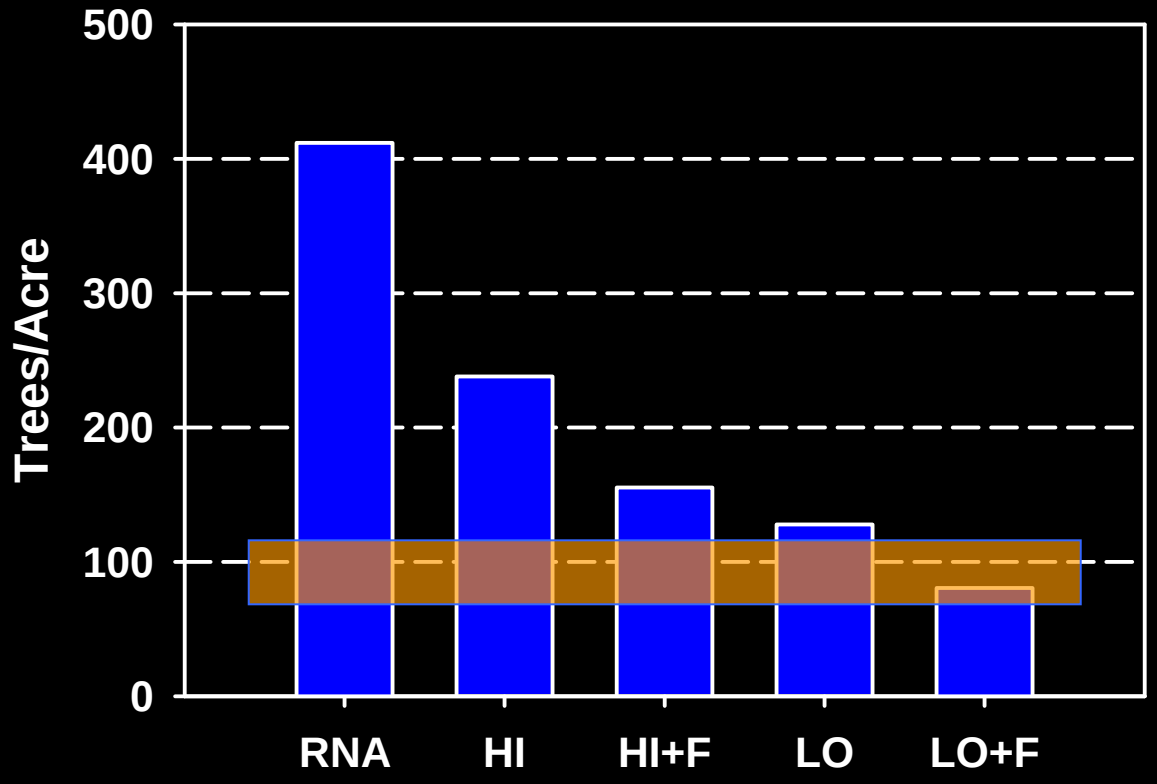
HiD – No RxBurn

HiD – RxBurn

LoD – No RxBurn

LoD – RxBurn

Blacks Mt Stand Structure



Ritchie et al. 2008
Zhang et al. 2008
Stephens & Gill 2005
Oliver 2001

Small Mammals

- • Yellow pine chipmunk, golden-mantled ground squirrel, and the deer mouse were the most common species found at Blacks Mountain (over 80%).
- • Yellow-pine chipmunks and deer mice decreased as basal area (m^2ha^{-1}) increased, but the opposite occurred with the golden-mantled ground squirrel.
- • Golden-mantled ground squirrels more abundant in high structural diversity (HiD) treatments, yellow-pine chipmunks more abundant in low structural diversity (LoD) treatments.

Birds

- • Few differences in occupancy of bird species and no differences in species richness were found between structural treatments.
- • Estimates of species-richness ranged from 17 to 37 (mean=24 ± 1se), regardless of structural treatments or prescribed fire.
- • Treatments did not change snag densities and cavity availability. Snag retention may partially explain why there were no substantial shifts in species richness.

Old Growth – RNA's

- • Over a period of about 65 years, the condition of large old trees at Blacks Mountain deteriorated substantially. There was an influx of young poles and saplings and a substantial decrease in density of large trees > 24 inches in diameter.
- • Prospects for the largest trees are bleak in these unthinned stands as reduced growth rates and increased mortality are continuing.
- • Treated stands have much lower rates of mortality and higher growth rates, increasing the numbers of large trees.

Silviculture

- • Low structural diversity (LoD) treatments showed slightly higher growth for basal area, and a significantly higher diameter increment, than did high structural diversity (HiD) treatments.
- • The reduction in stand density did not affect species composition (50:40:10 ponderosa and Jeffrey pine: white fir:incense-cedar).
- • Cover and number of species of understory vegetation showed no difference between structural treatments.

Cone Fire

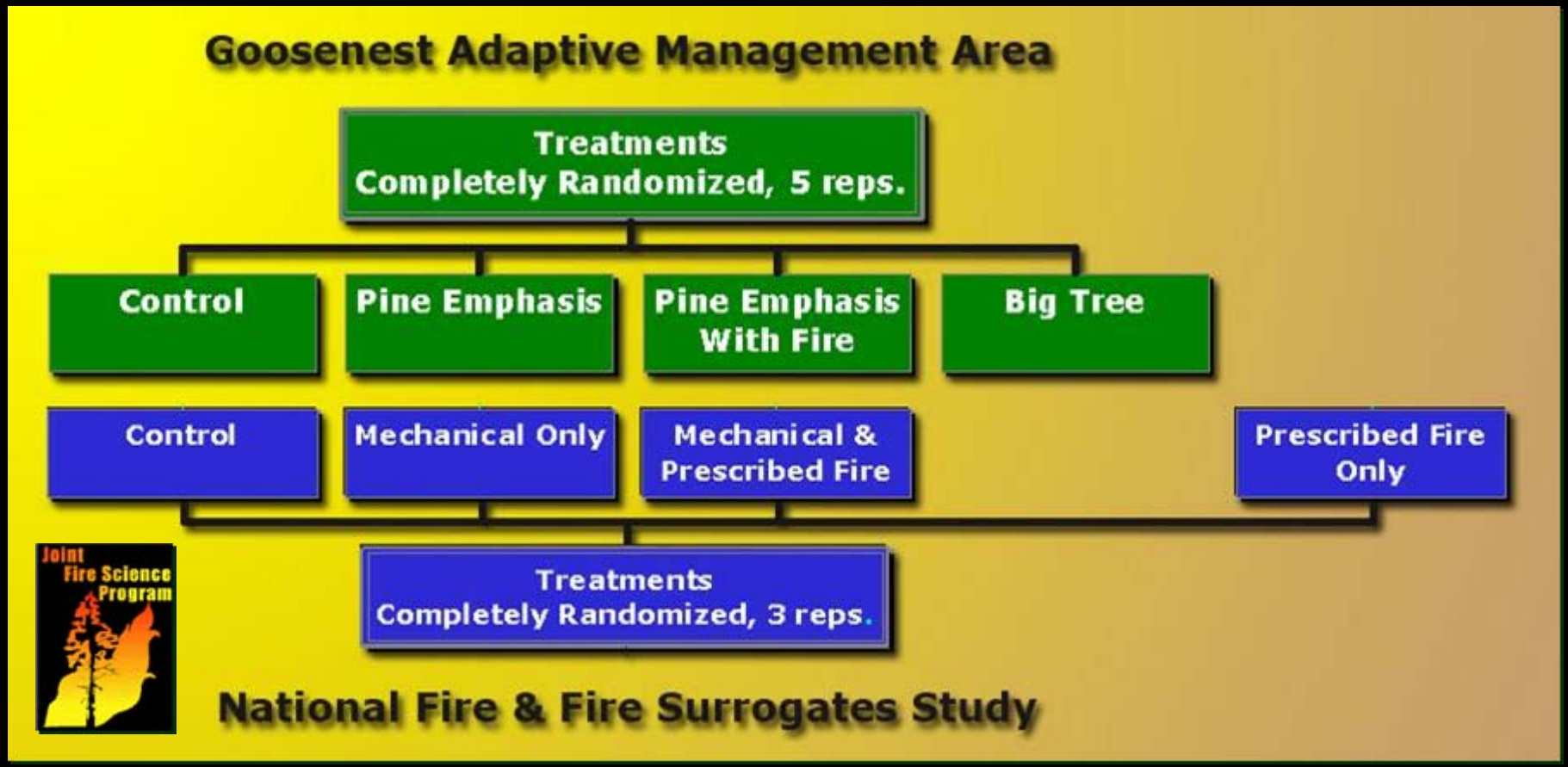
A. No Treatment

B. Thinned – No RxBurn

C. Thinned with RxBurn

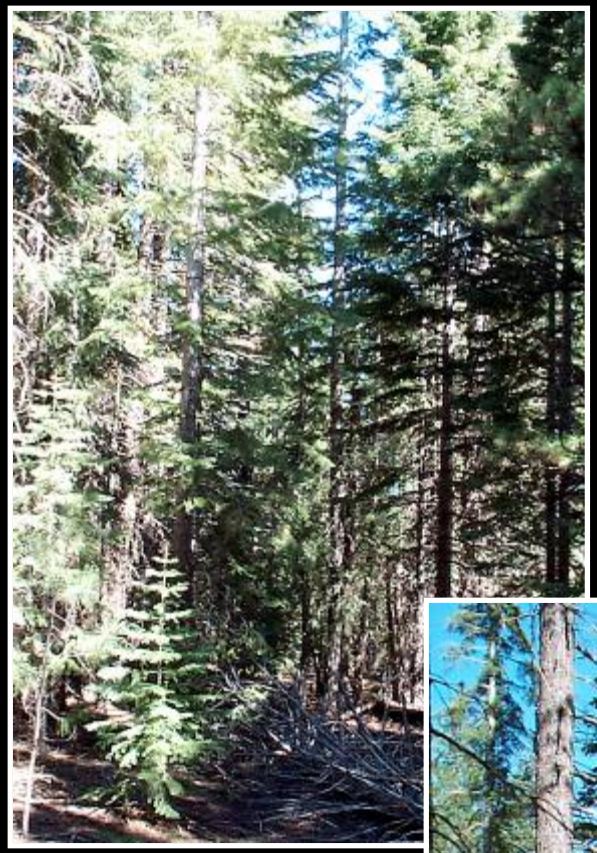
Goosenest Adaptive Management Area study

- **Objective: accelerate development of large tree component of late-seral stands**
- **Treatments: pine emphasis, pine emphasis w/ fire, large tree emphasis, control**
  - Pine emphasis: all dom/codominant pines >12” retained; leave trees spaced based on dbh; 15% of area in 0.5-3ac group openings - planted
  - Large tree emphasis: thinning from below keeping largest trees, even spacing
- **100 acre units + buffer; implementation completed 2001**
- **Multidisciplinary – wildlife (birds, small mammals), tree growth, understory veg. etc.**



Interdisciplinary Studies

Fuels Soils Wildlife Pathology
Entomology Vegetation Finances Social



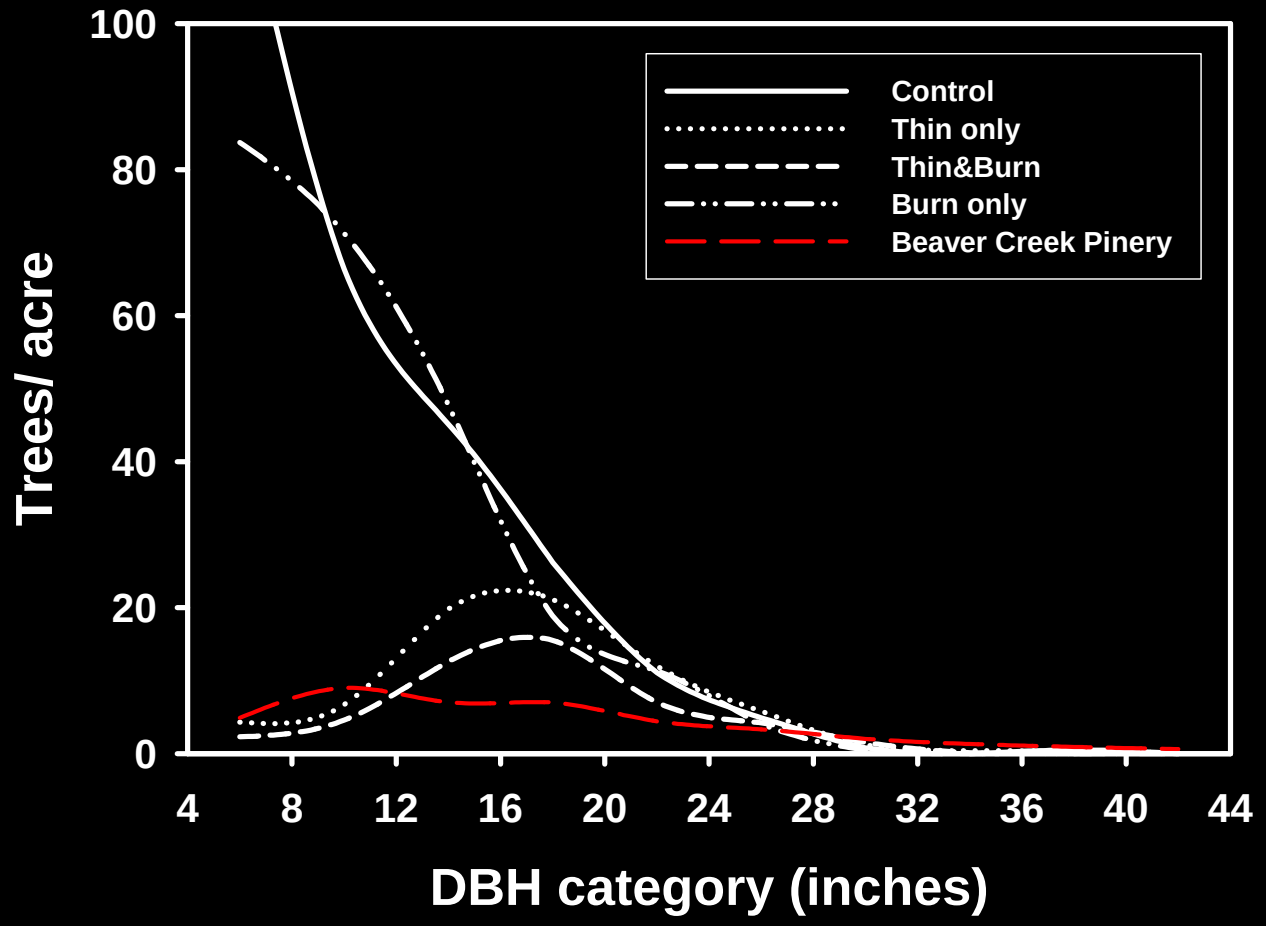
Untreated
Control

Prescribed
Fire
Alone

Mechanical
Thin
Alone

Mechanical
Thin +
Prescribed
Burn

South Cascades FFS vs. Beaver Creek Pinery



Some lessons learned

- Marking – challenges posed by non-standard prescriptions
- Wildlife studies require large units
  - trade-offs with replication / statistical power
  - Expensive
- Questions are long-term, but difficult to secure long-term funding for studies


Thank You