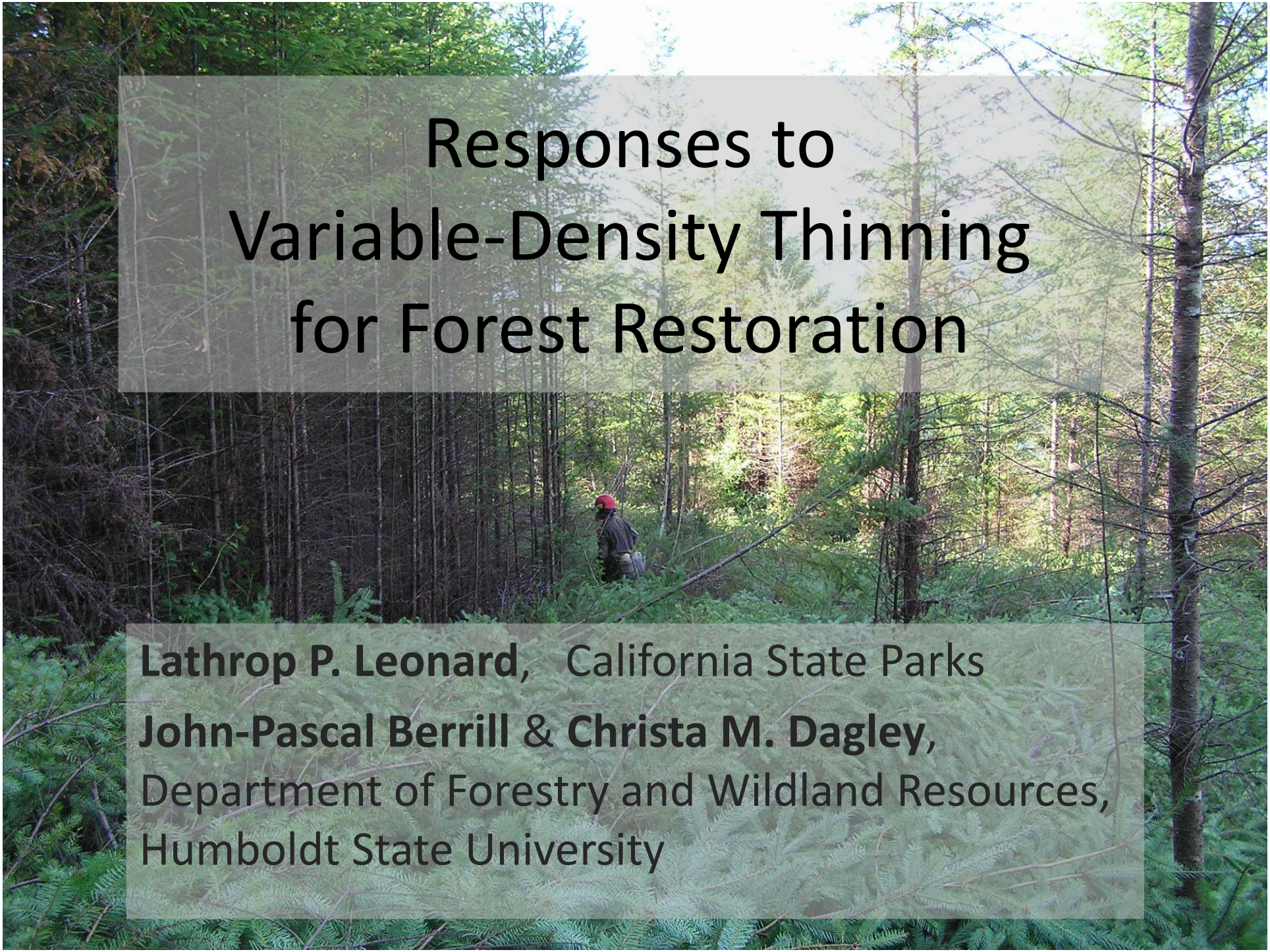


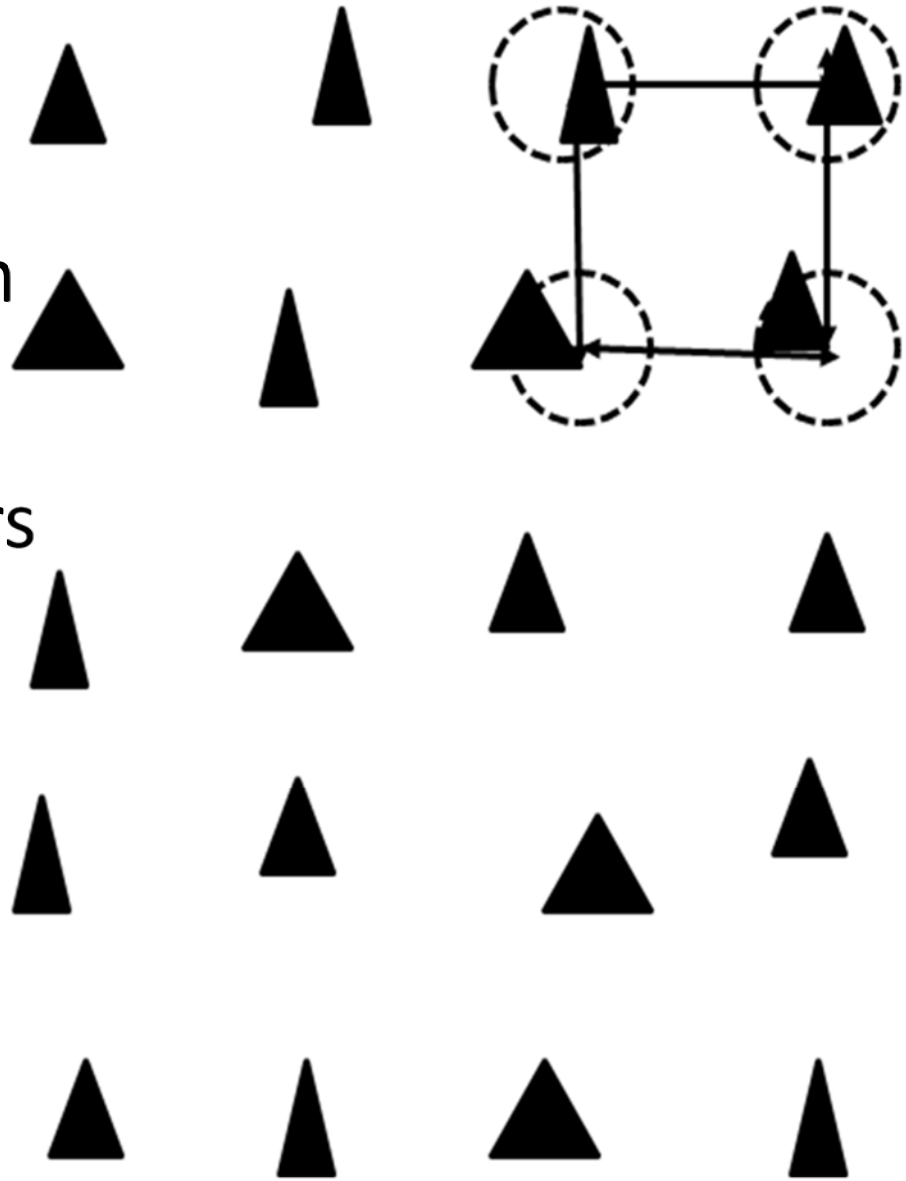
Responses to Variable-Density Thinning for Forest Restoration

Lathrop P. Leonard, California State Parks

John-Pascal Berrill & **Christa M. Dagley**, Department of Forestry and Wildland Resources, Humboldt State University

Treatments

- **High Density** – 4.9 x 4.9 m
- +/- 1.2 m
- Choose RW, minor conifers
- RW clumps = 1 tree
- Leave some brush,
  small trees



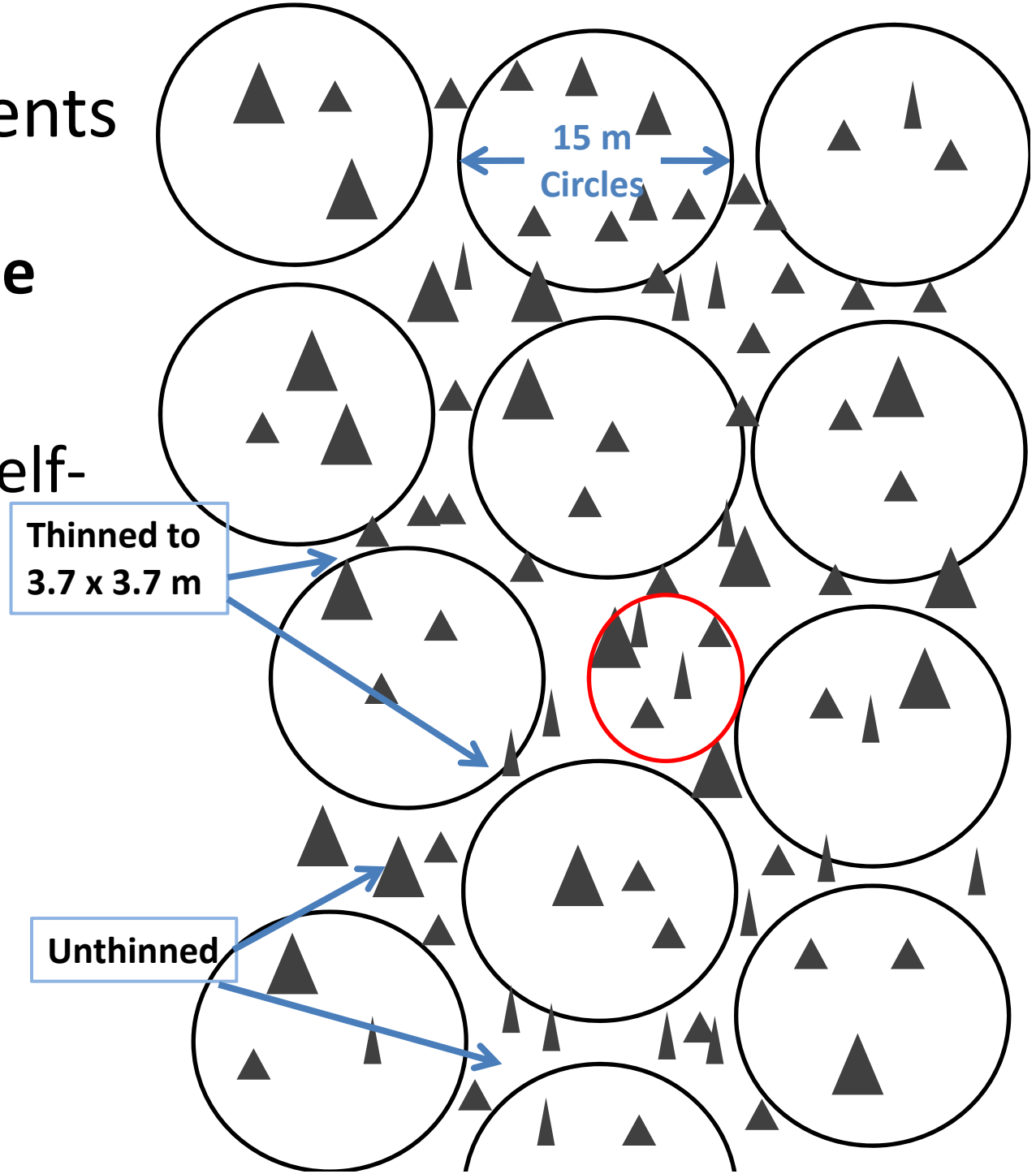
Treatments

Low Density – 6.1 x 6.1 m

Treatments

Localized Release

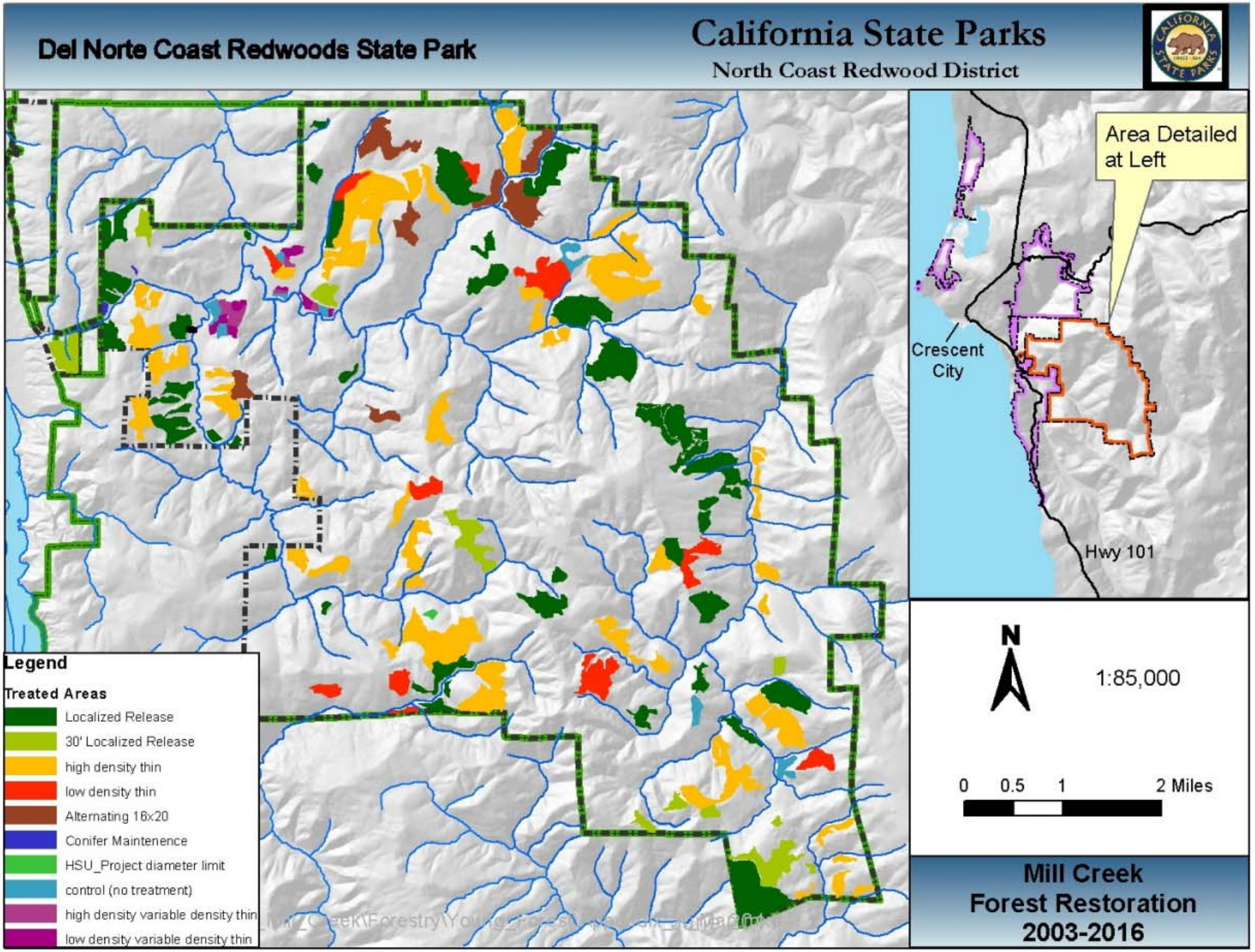
- Encouraging self-thinning



Efficiency of Implementation

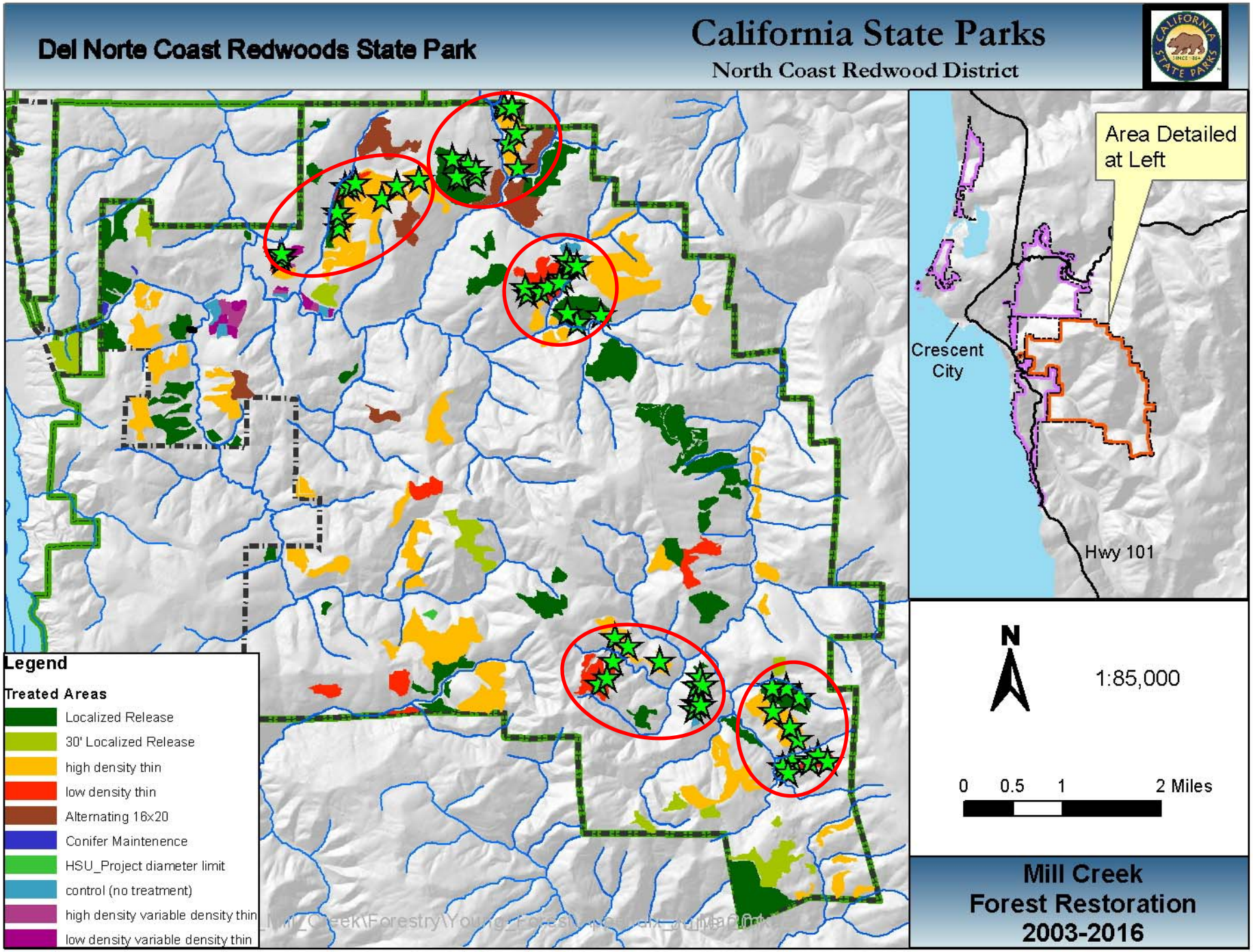
Implementation rate: hectares treated, per person, per day

- Localized Release = **0.79** ha/pp/day
- High Density (4.9 x 4.9 m) = **0.56** ha/pp/day
- Low Density (6.1 x 6.1 m) = **0.53** ha/pp/day


Del Norte Coast Redwoods State Park
California State Parks
North Coast Redwood District
Area Detailed at Left
Crescent City
Hwy 101
Legend
Treated Areas
Localized Release
30' Localized Release
high density thin
low density thin
Alternating 16x20
Conifer Maintenence
HSU_Project diameter limit
control (no treatment)
high density variable density thin
low density variable density thin
N
1:85,000
0 0.5 1 2 Miles
Mill Creek
Forest Restoration
2003-2016

Experimental Design

- Treatments randomly assigned within blocks (except some controls)
- 3 plots / treatment area
- 5 replicates (blocks) = 60 plots
- Plots established after treatment (Year 0), re-assessed after four years (Year 4)


Del Norte Coast Redwoods State Park
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N
1:85,000
0 0.5 1 2 Miles
Mill Creek
Forest Restoration
2003-2016

Research Questions

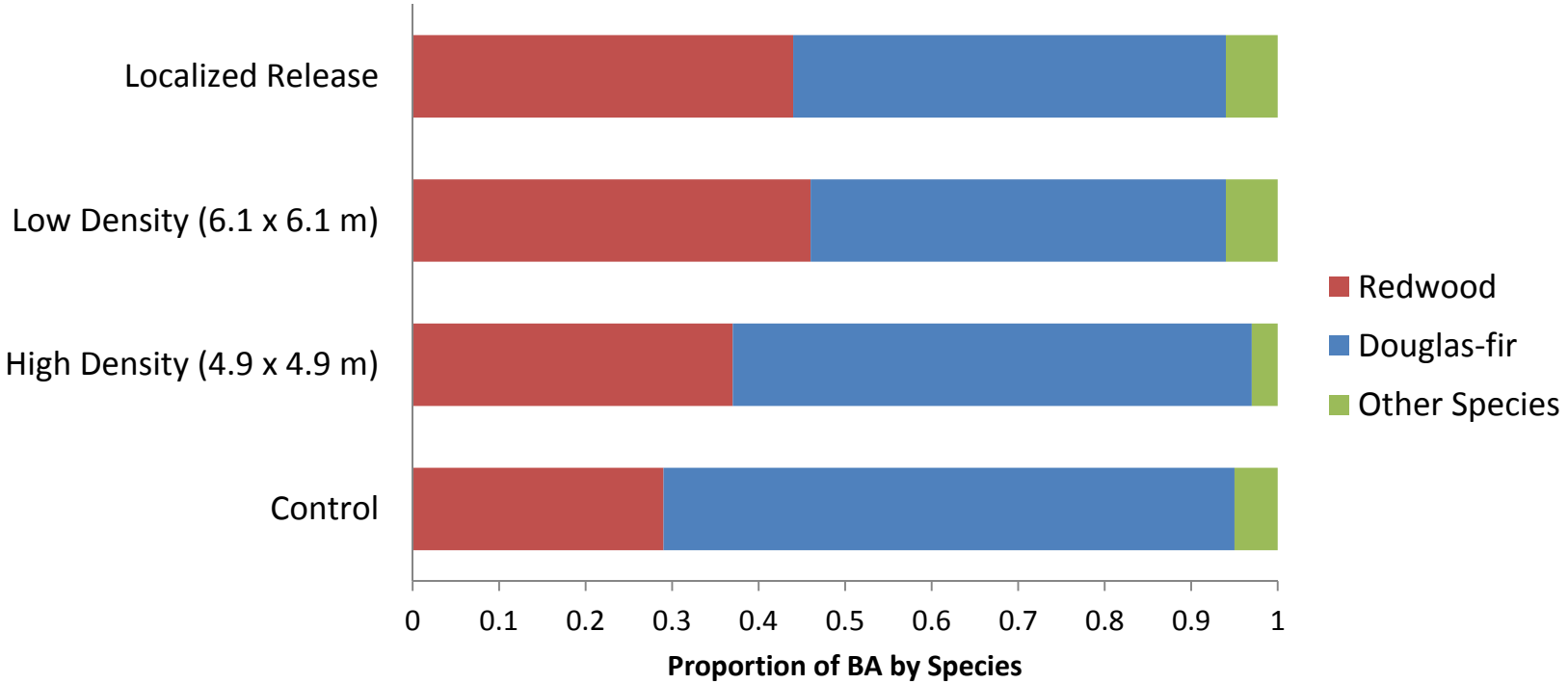
After VDT treatments,

- How did treatments alter
  - tree species composition?
  - stand density & structural diversity?
- How fast did trees grow?
- How many trees sustained bear damage?
- How deep was slash (fuels) and did it change?

(+ planned work: understory light & vegetation; diversity index)

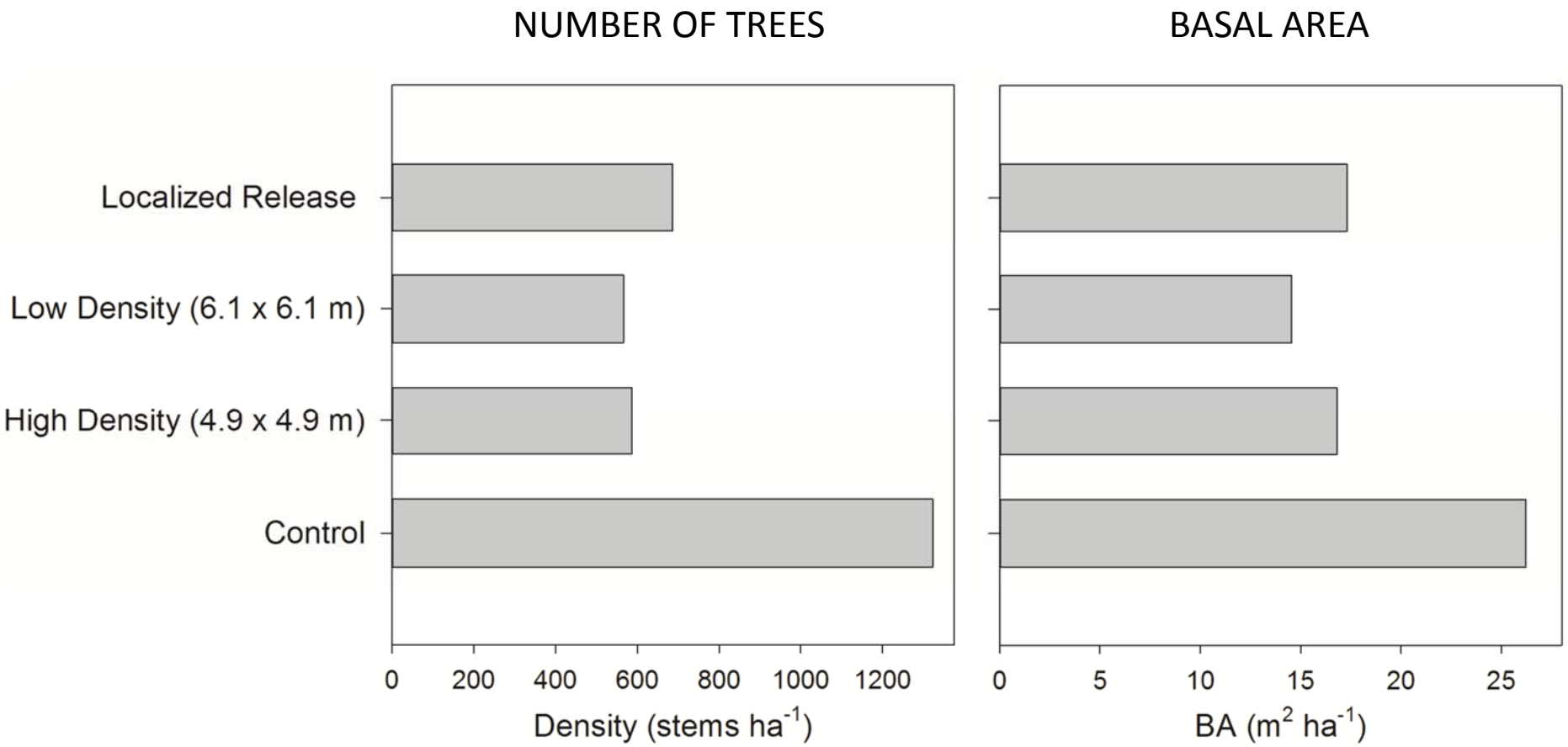
Species Composition

Low density thinning best promoted redwood and reduced Douglas-fir



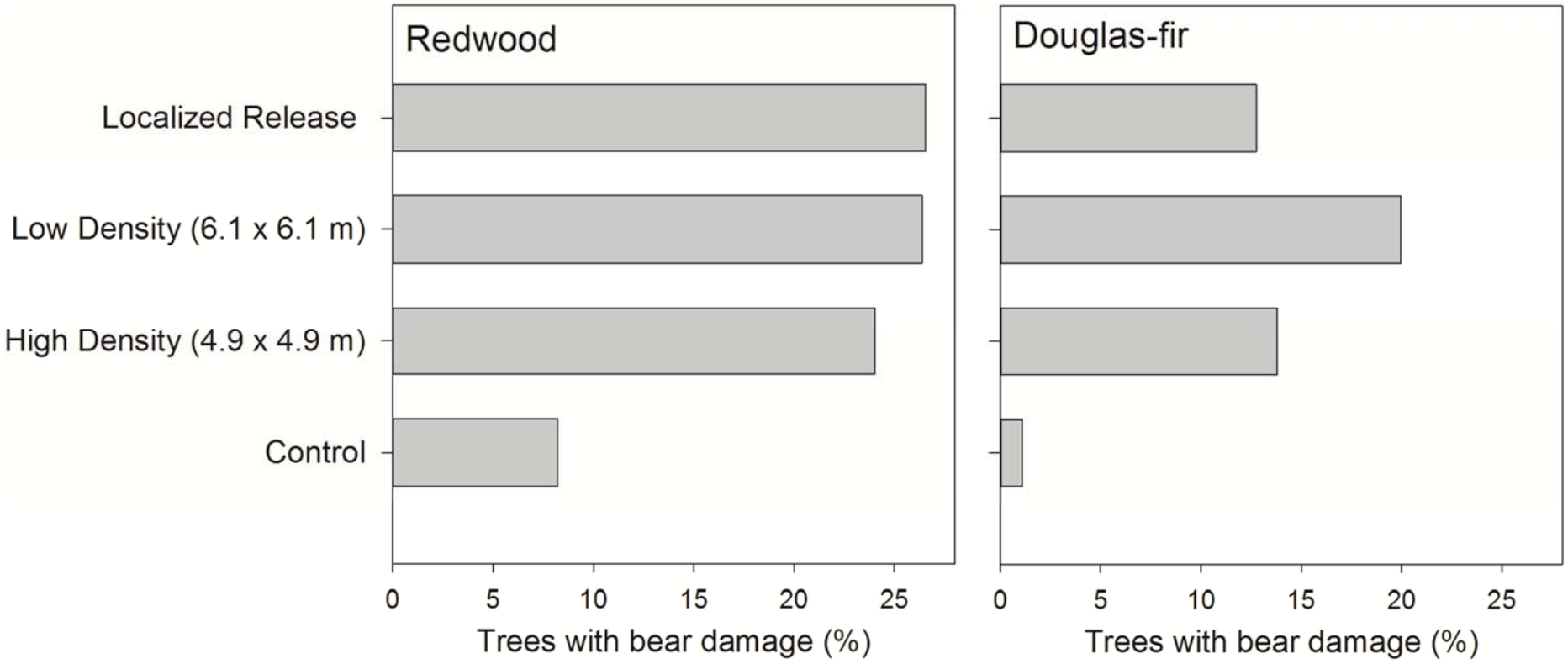
Stand Density

Low density thinning most reduced tree numbers and basal area



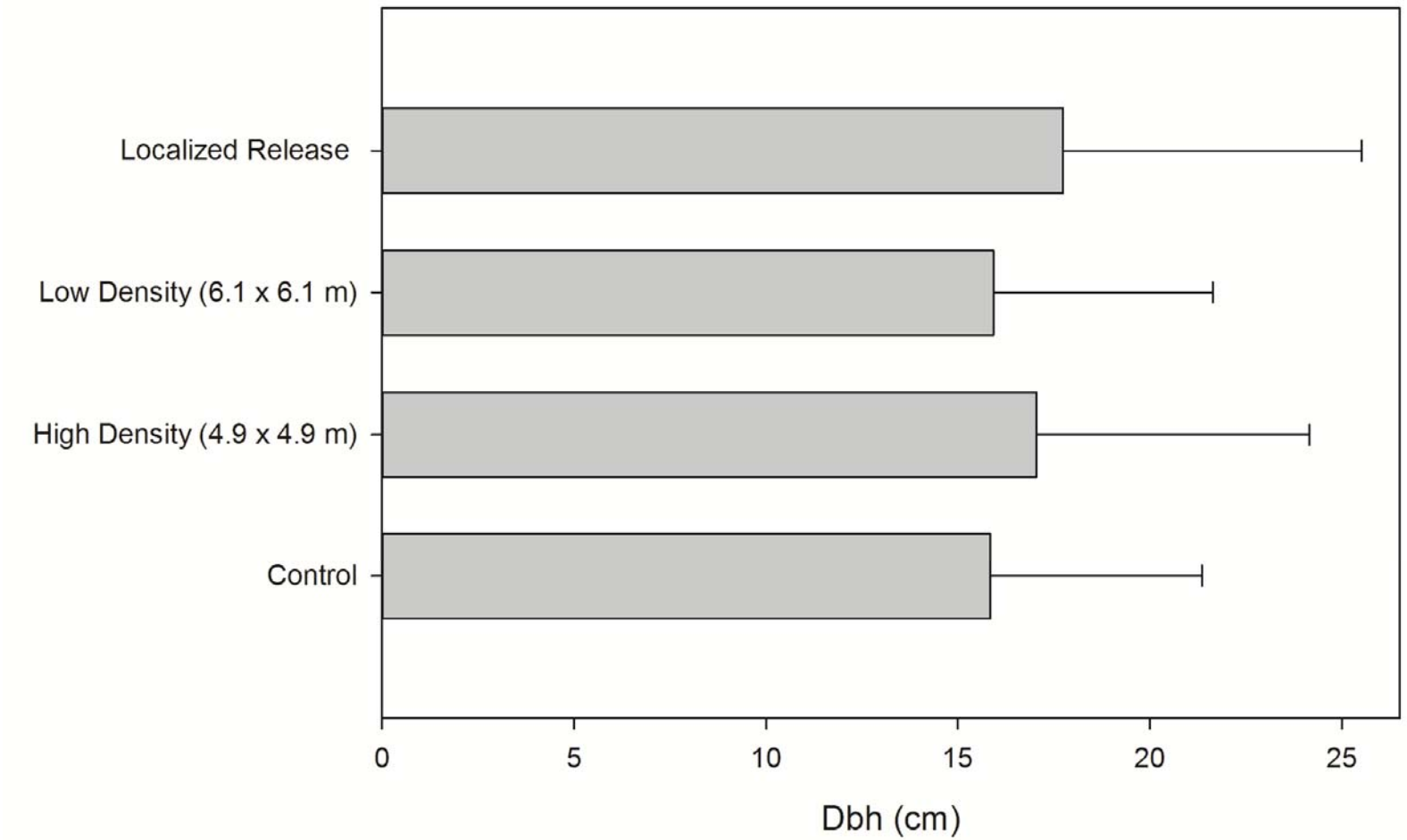
Bear Damage in Redwood & Douglas-fir

- Bears prefer redwoods
- Thinning leads to damage



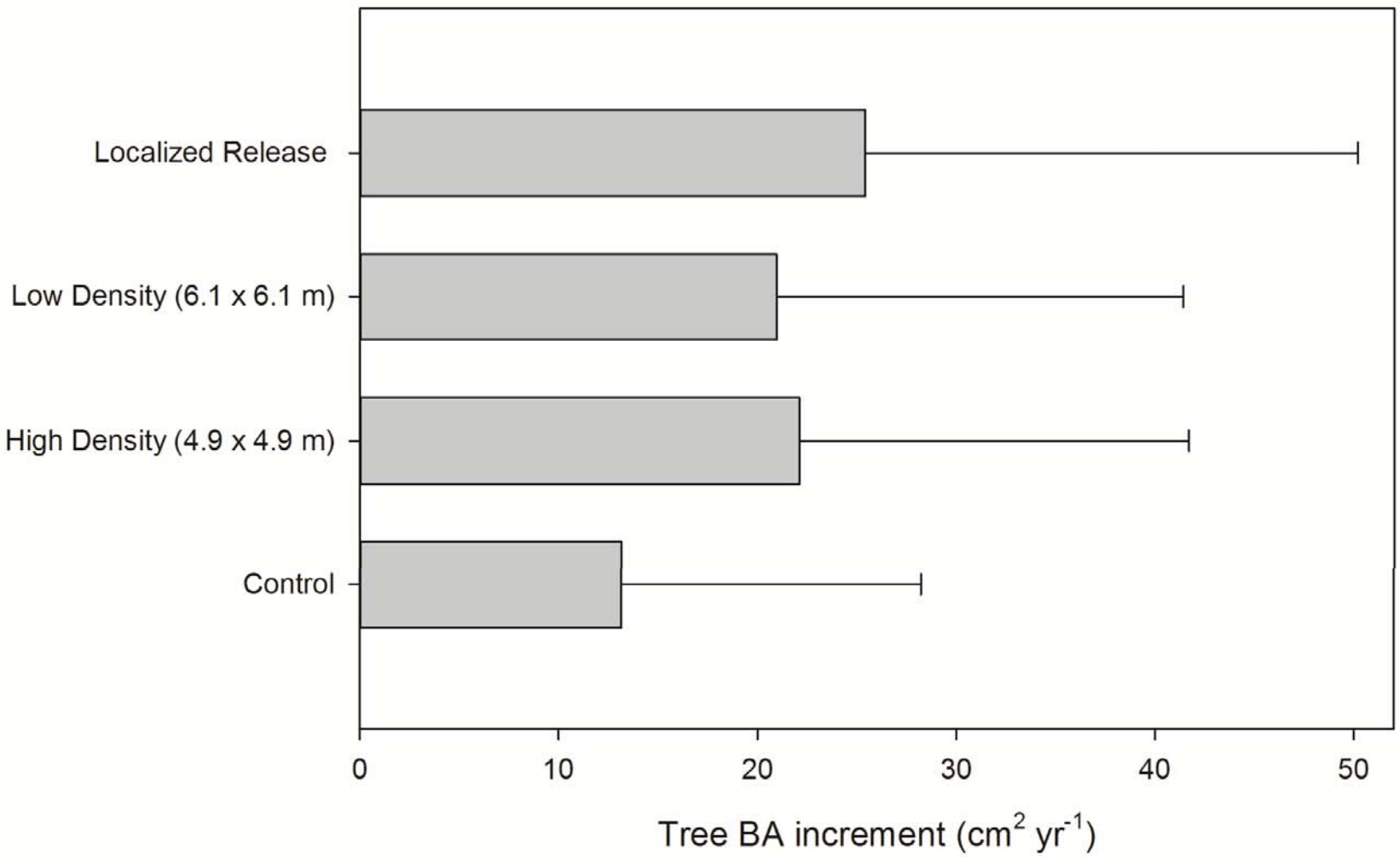
Redwood Tree Size

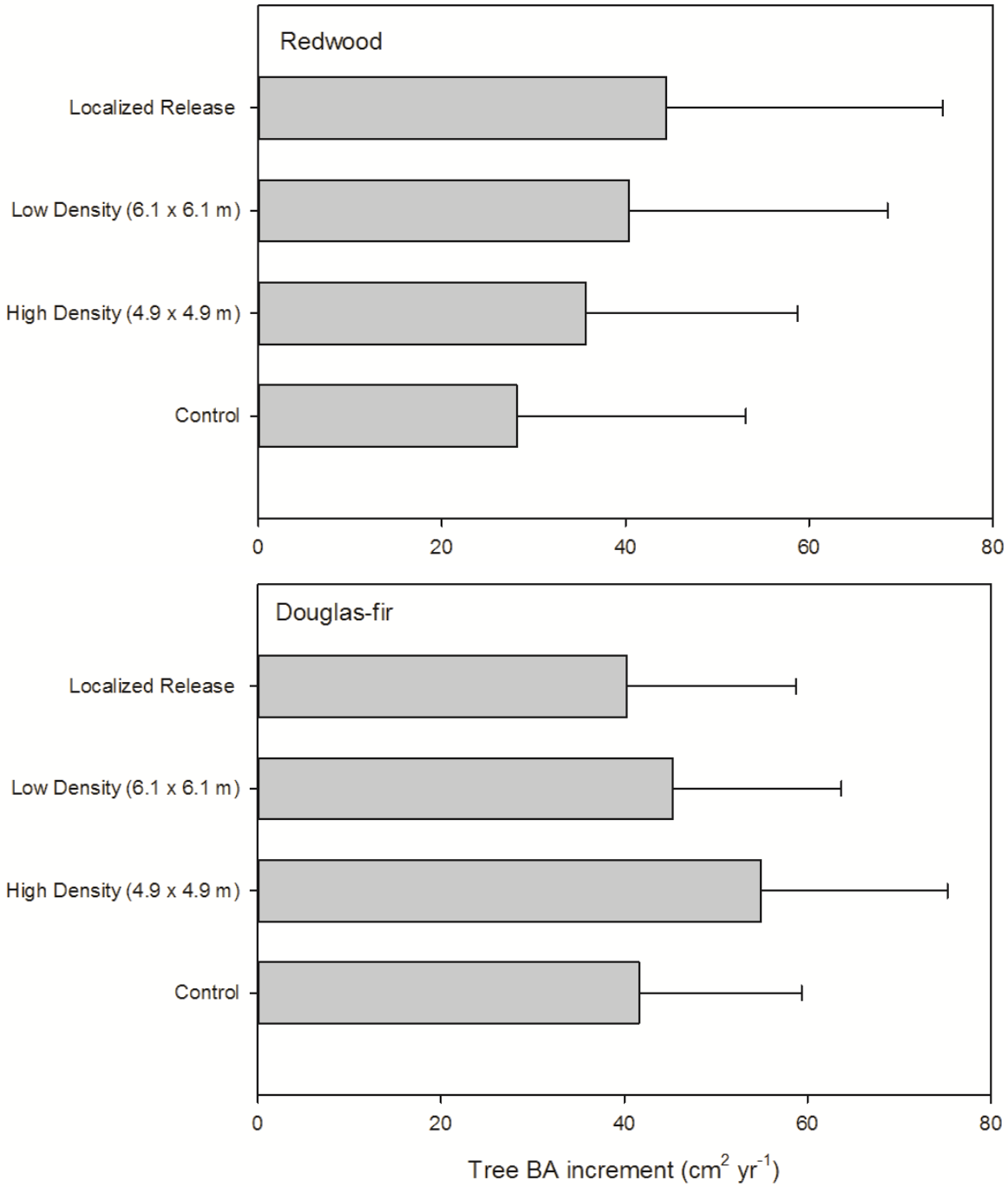
Average size of undamaged redwood was slightly larger and more variable after localized release and high density thin



Undamaged Redwood Growth Rates

Tree BA increment was greatest, more variable for localized release





Dominant Tree Growth Rates

Diameter growth of largest 100 stems/ha (40 tpa) assumed to represent restored old-growth overstory

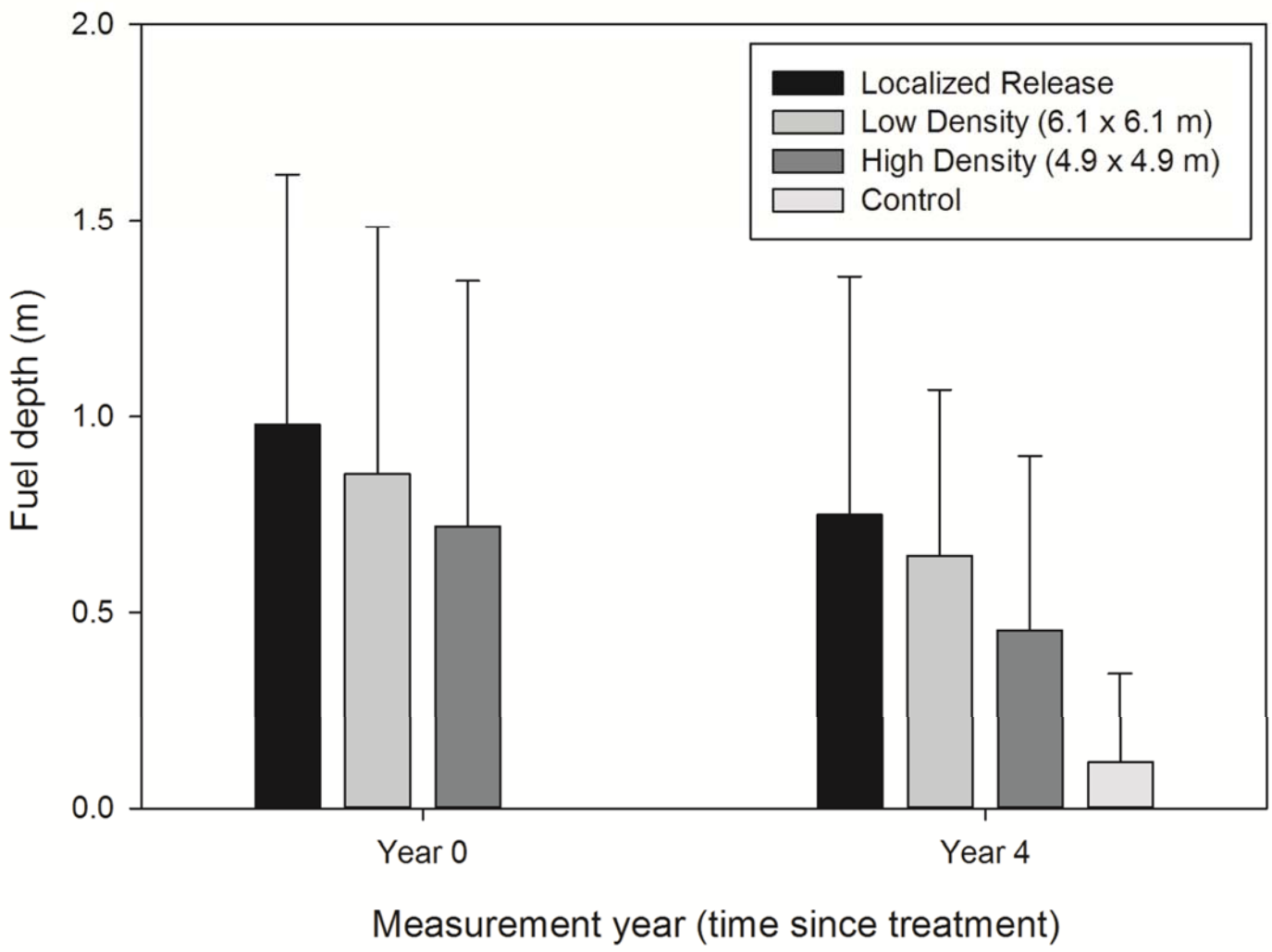
(i.e., 50 largest RW & 50 largest DF/ha)

Localized release: favors RW while restricting DF

Slash Depth

Slash (Fuel Bed) Depth

- Slash depth highly variable across each treatment



Summary

As a result of VDT treatments,

- slash (fuel bed) deepest: LR > LDT > HDT >> Control
  (but dense Controls are also a fire hazard)

- bear damage among redwoods: LR ≈ LDT > HDT >> Control
  (good or bad for restoration objectives?)

- bear damage among Douglas-fir: LDT > LR ≈ HDT >> Control
  (good or bad for restoration objectives?)

Summary

As a result of VDT treatments,

- composition shift towards redwood:

LDT > LR > HDT

- structural diversity:

LR > LDT ≈ HDT > Control

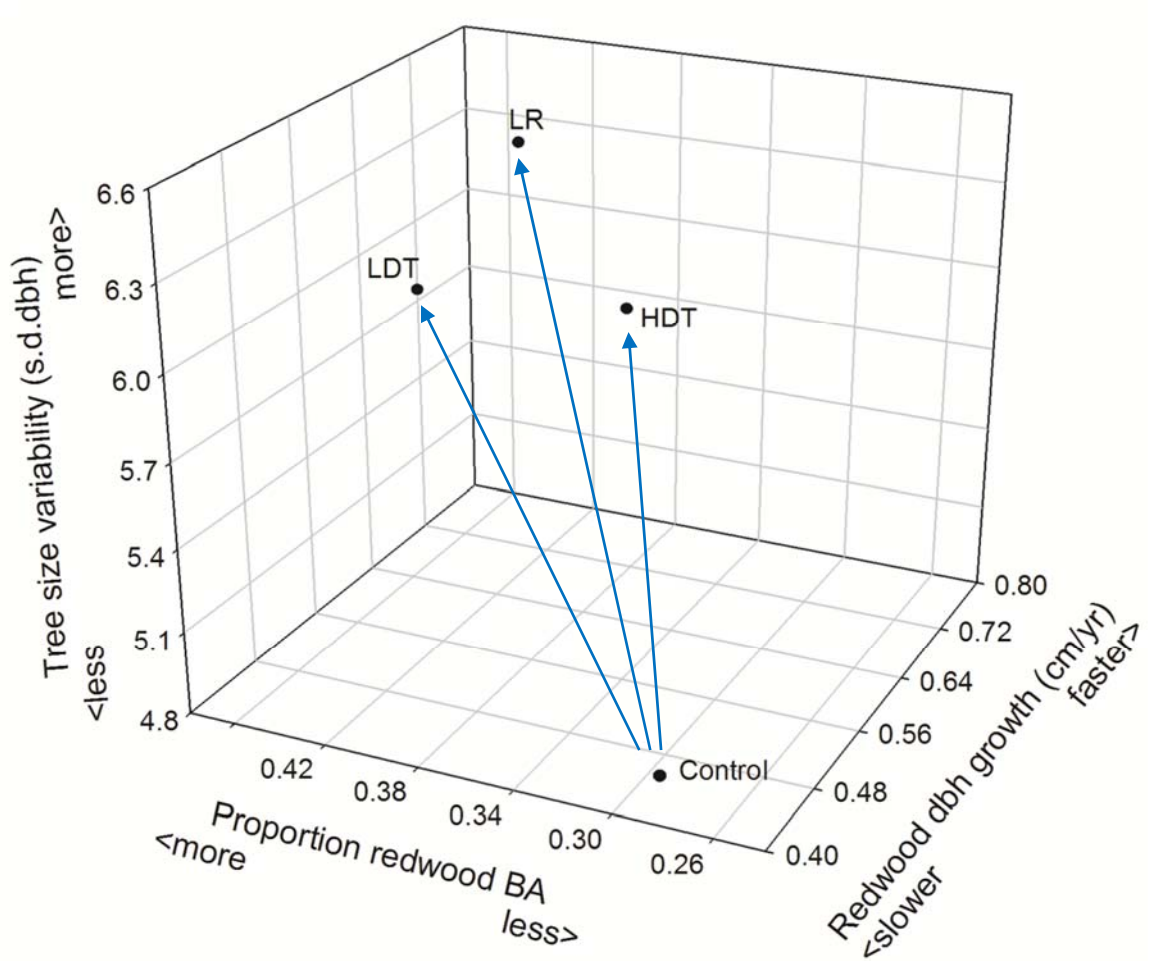
- redwood dbh growth:

LR > LDT ≈ HDT > Control

- efficiency

LR > HDT > LDT

Creating complexity isn't always expensive



Acknowledgements