

Treatments mediated Castle Fire impacts to the Mountain Home Giant Sequoia Grove

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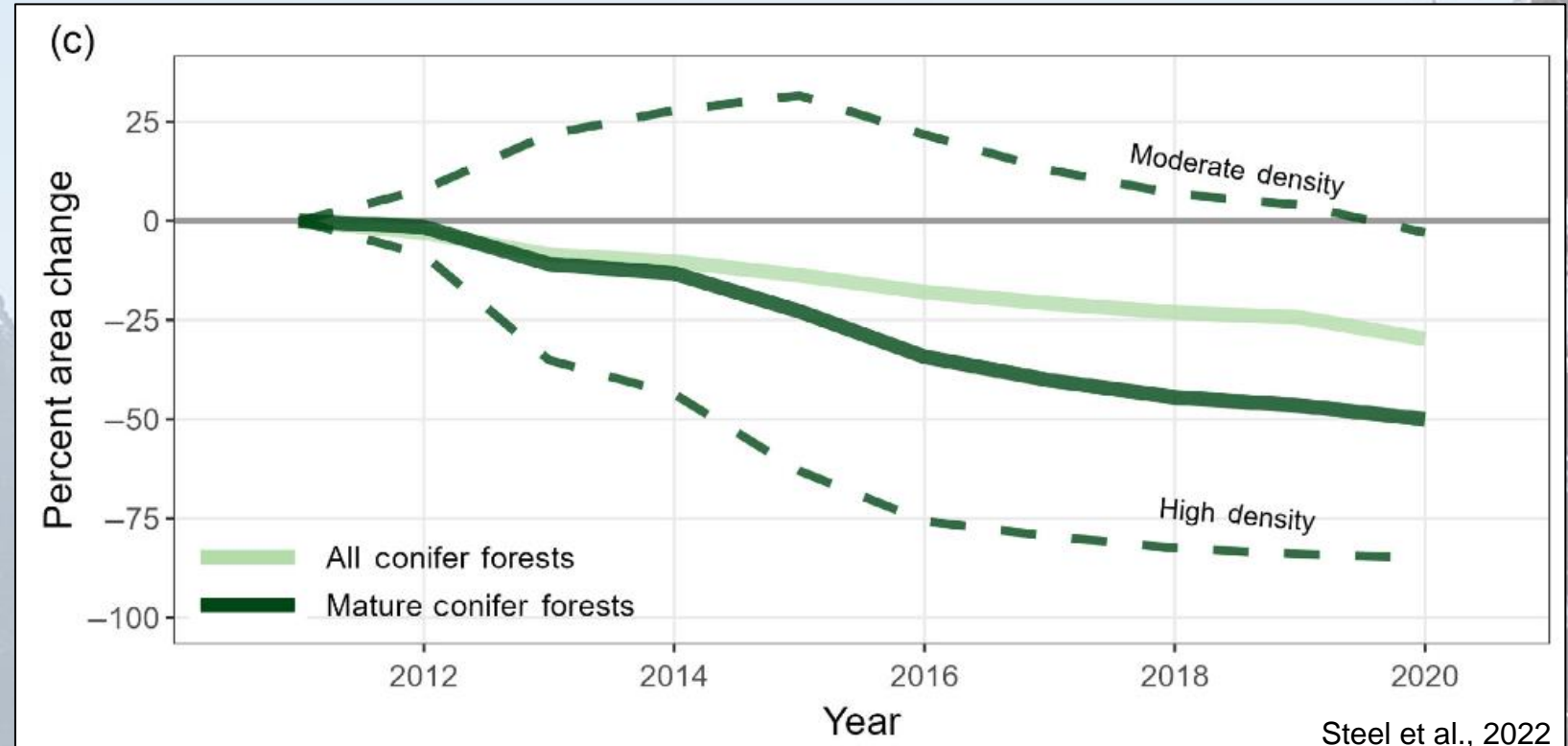
Sarah Bisbing

Forest Loss in the Southern Sierra

Drought Stress

Bark Beetles

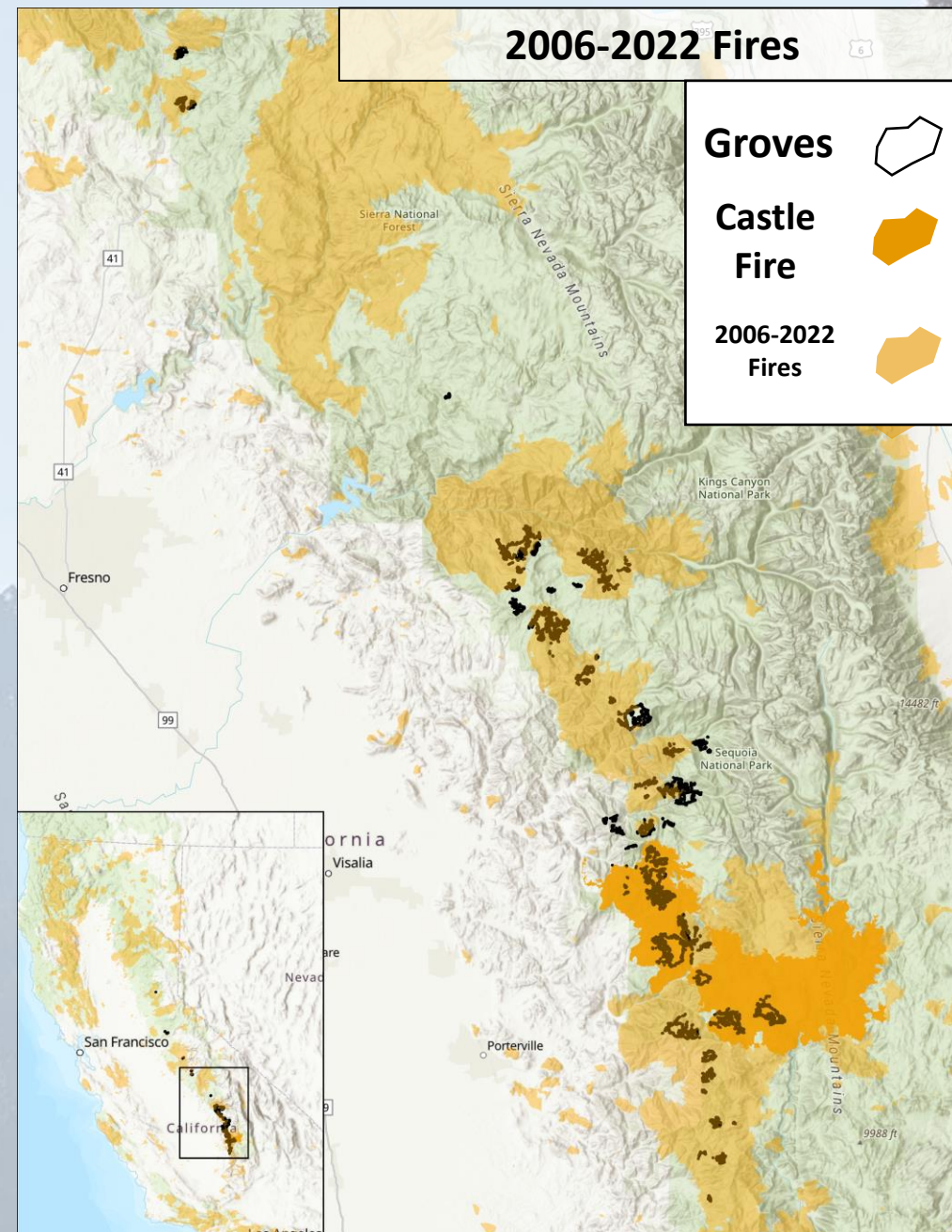
High-severity fire





~10-12% of burned
grove area has
burned at **high-
severity**

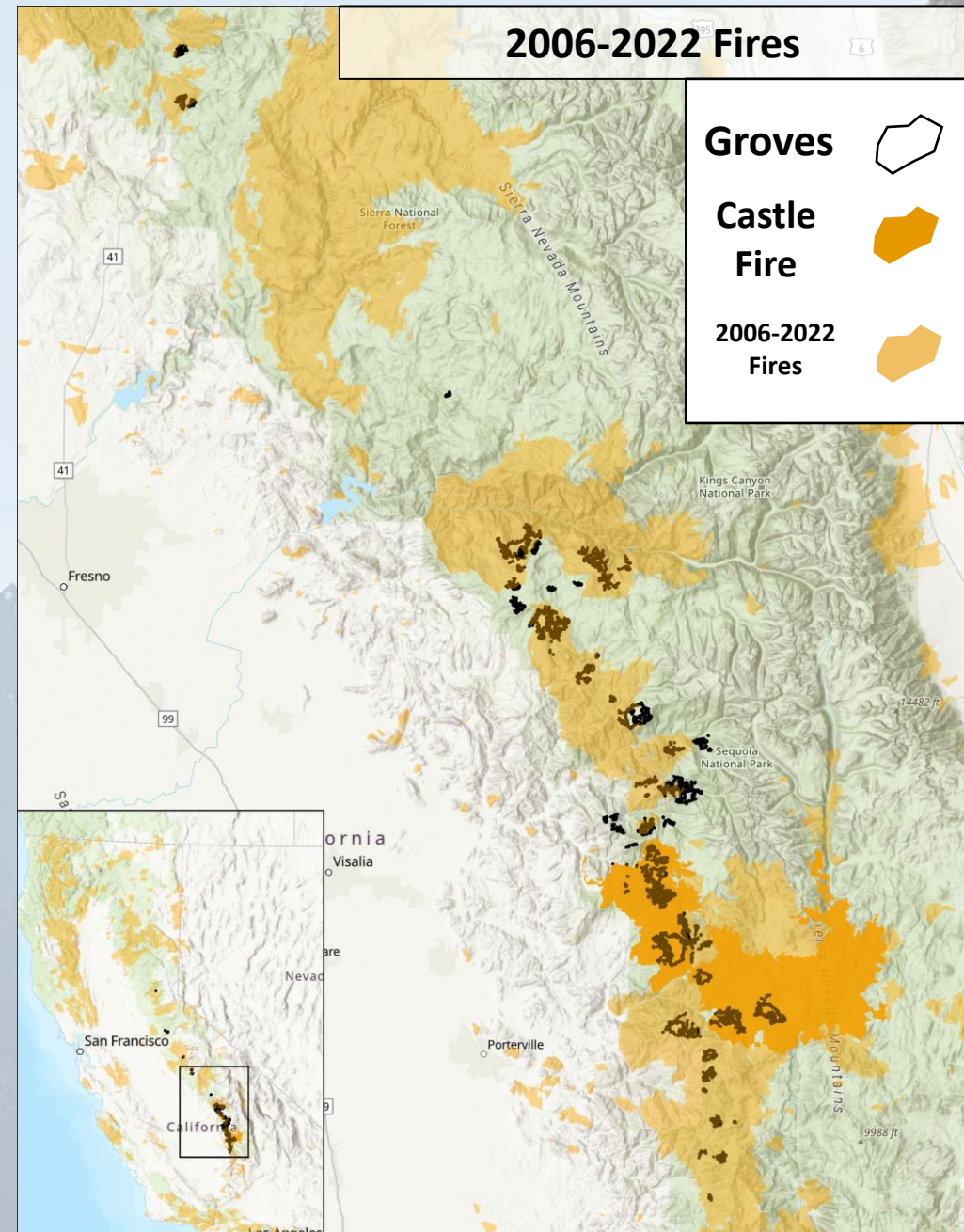
My back-of-the-envelope math



~10-12% of burned grove area has burned at **high-severity**



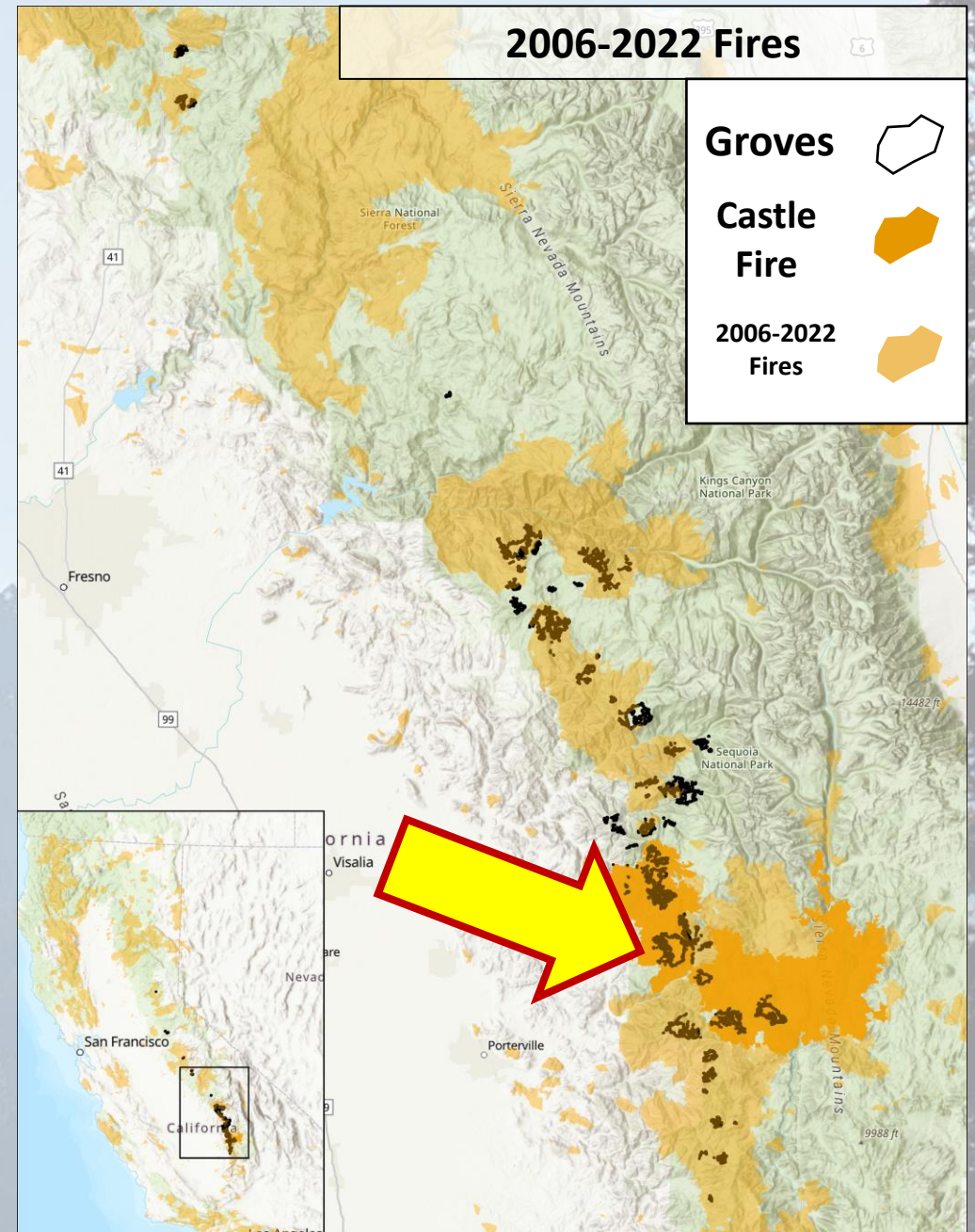
Loss of 13-19% of all large giant sequoia
Shive et al 2021
Stephenson & Brigham, 2021



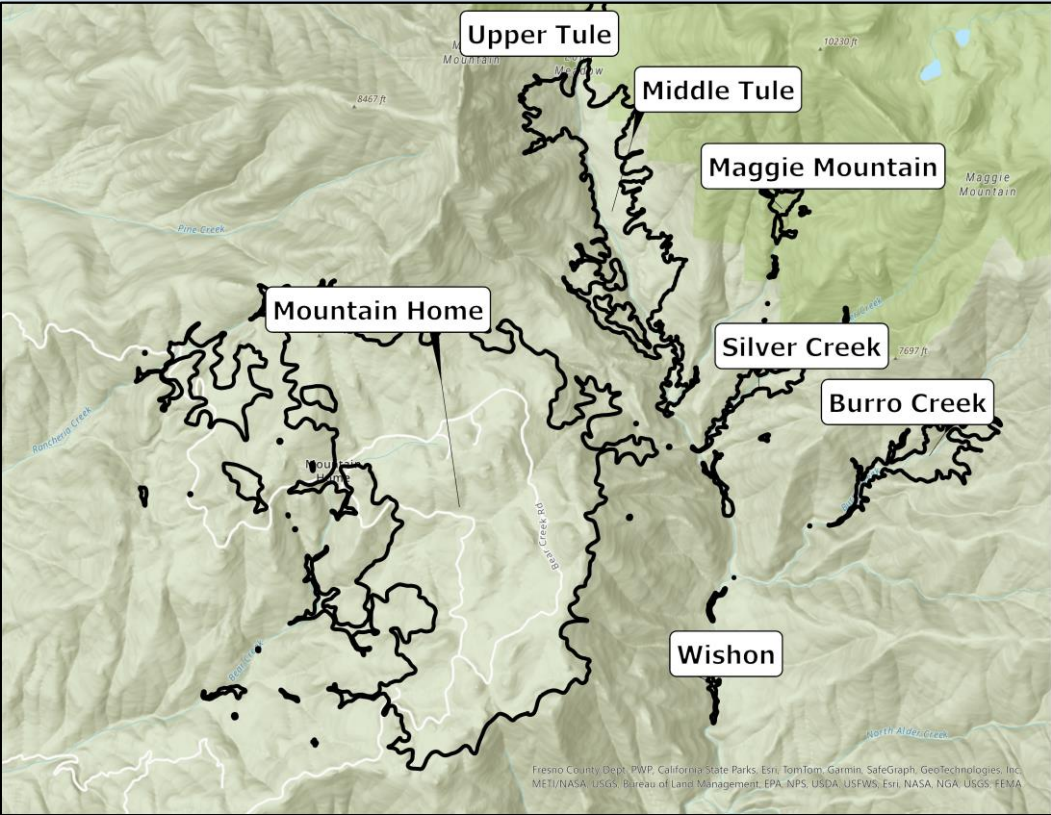
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Loss of 13-19% of all large giant sequoia
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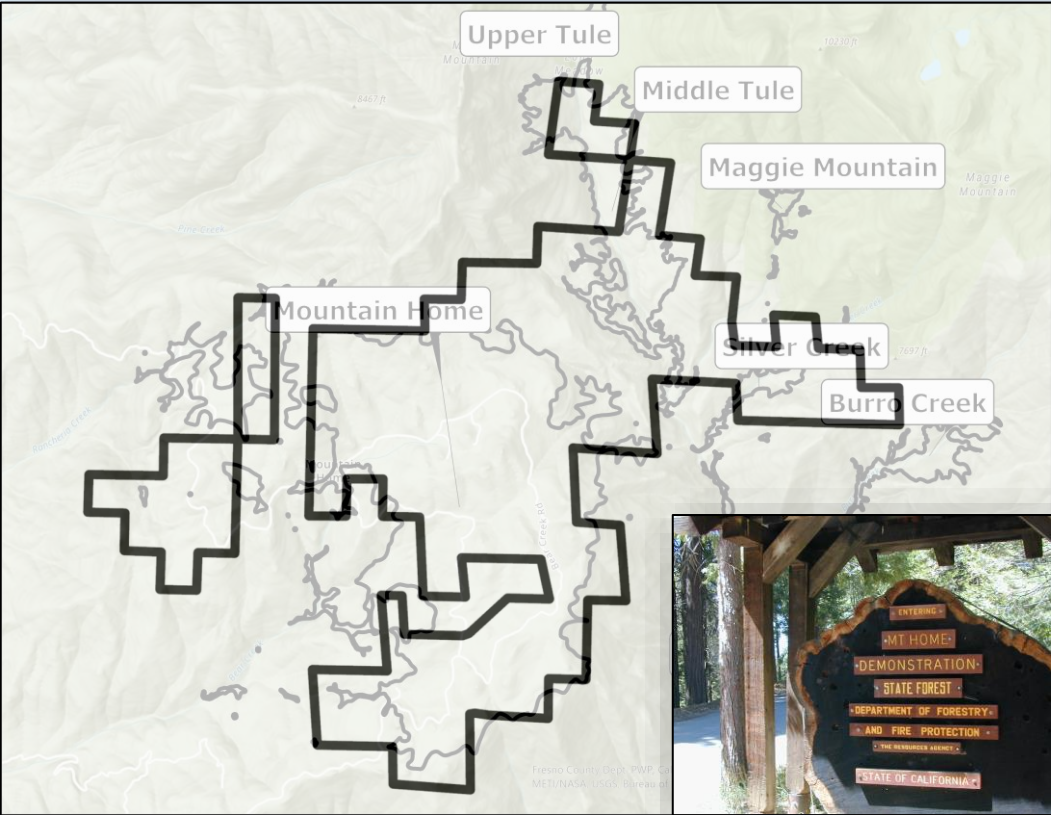


Mountain Home Demonstration State Forest



Pre 1870:
FRI~15 years
Active
Indigenous
management

Mountain Home Demonstration State Forest



1870s

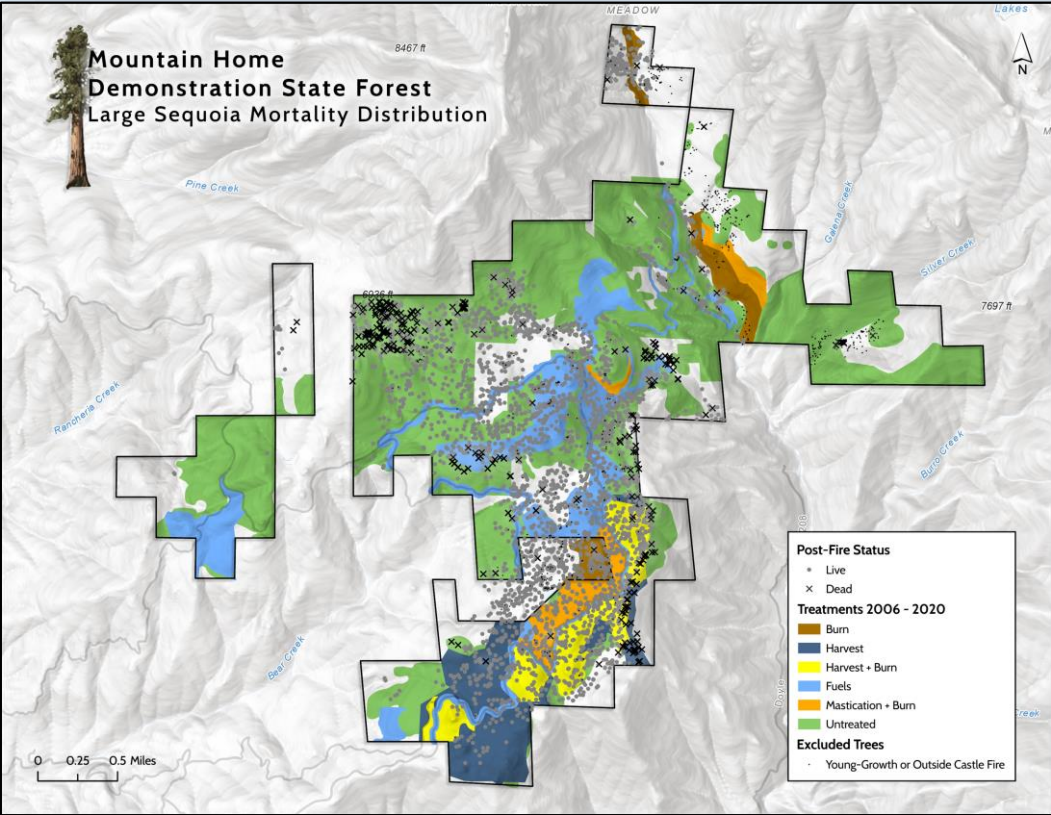
1946

Pre 1870:
FRI~15 years
Active
Indigenous
management

OG
harvesting



Mountain Home Demonstration State Forest



1870s

1946

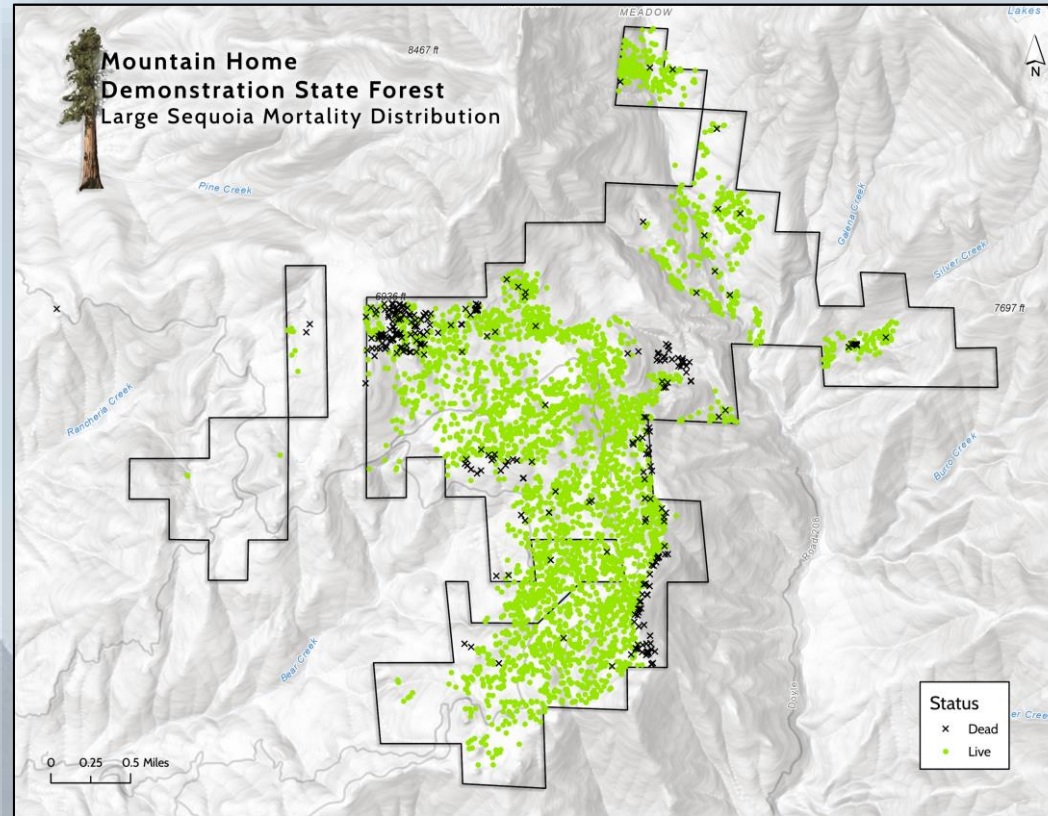
Pre 1870:
FRI~15 years
Active
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OG
harvesting



Active forest management to
Protect large sequoias

Mountain Home Demonstration State Forest



1870s

1946

Early 2000s

Pre 1870:
FRI~15 years
Active
Indigenous
management

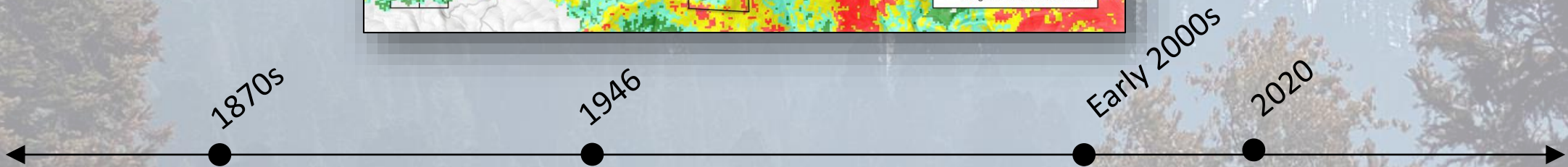
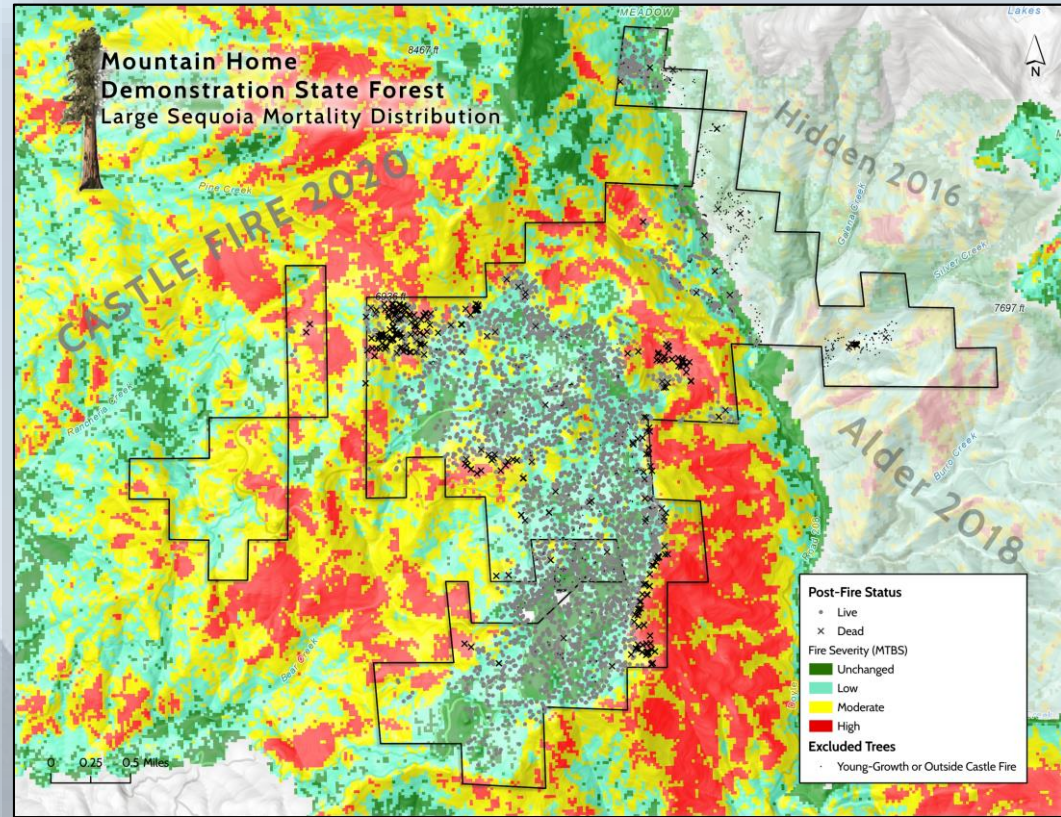
OG
harvesting



Large Sequoia
Inventory

Active forest management to
Protect large sequoias

Mountain Home Demonstration State Forest



Pre 1870:
FRI~15 years
Active
Indigenous
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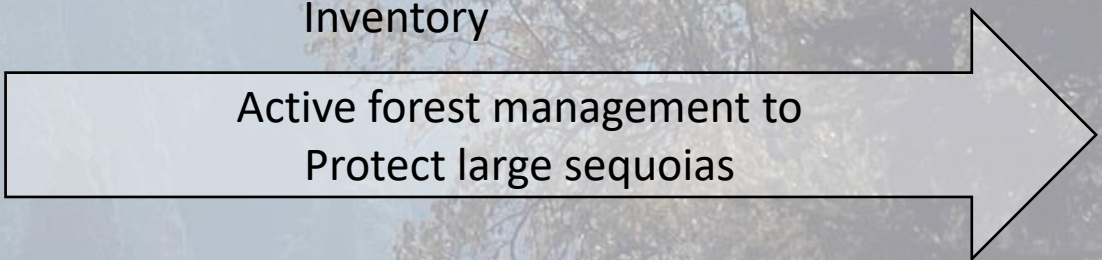
OG
harvesting



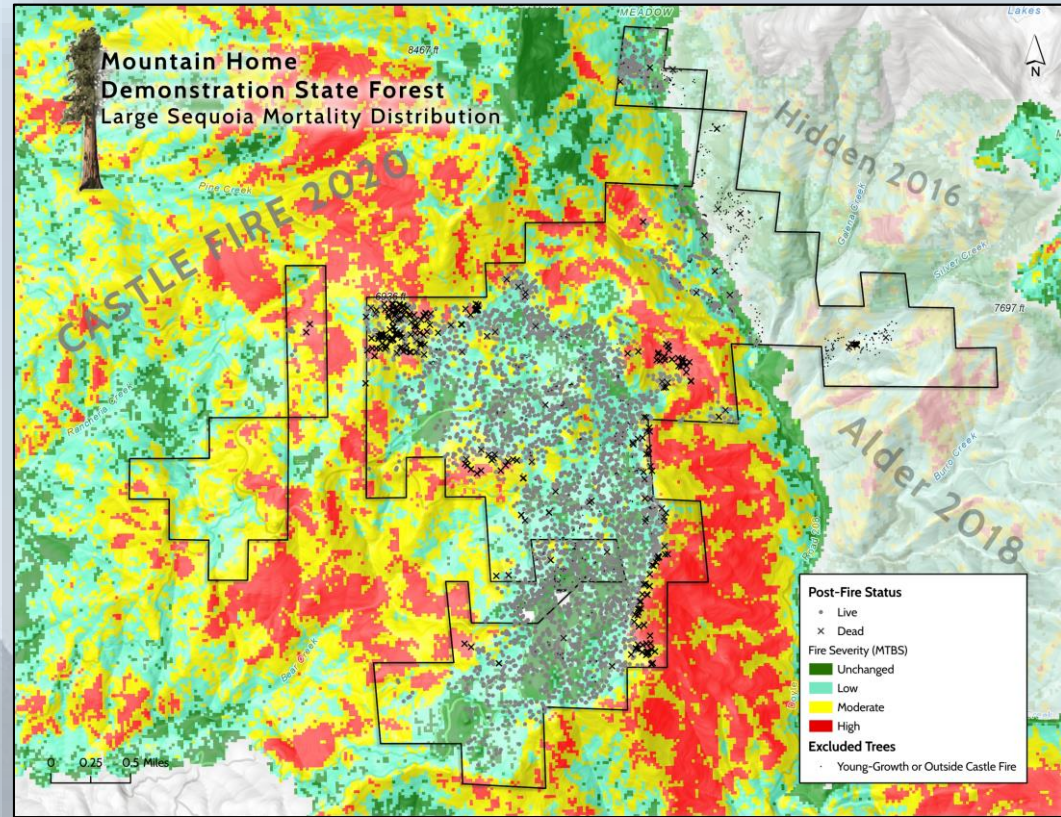
Large Sequoia
Inventory

Castle

Active forest management to
Protect large sequoias



Mountain Home Demonstration State Forest



1870s

1946

Early 2000s

2020

2021-2022

Pre 1870:
FRI~15 years
Active
Indigenous
management

OG
harvesting



Large Sequoia
Inventory

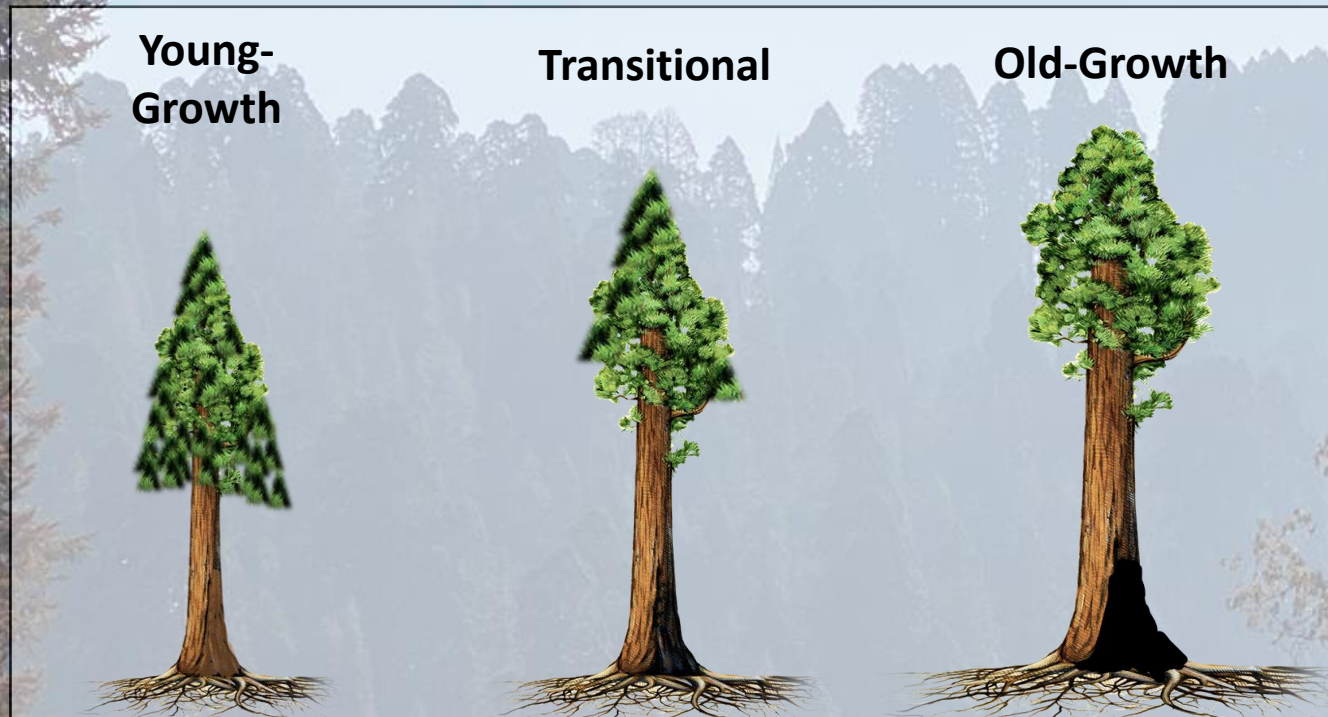
Castle

Post-fire
Inventory

Active forest management to
Protect large sequoias

Giant Sequoia Inventory

- 100% inventory of all large GS



**Mountain Home
Demonstration State Forest
Large Sequoia Mortality Distribution**

CASTLE FIRE 2020

HIDDEN 2016

MTBS Severity	% Acreage	# of trees (killed/Total)	% Mortality
Unchanged	20.3	7/1256	<1%
Low	41.3	31/2250	1.3%
Moderate	27.2	166/702	19.4%
High	11.2	98/123	79.7%
Total	100%	302/4331	6.9%

0 0.25 0.5 Miles



8467 ft

6026 ft

7697 ft

Pine Creek

Rancheria Creek

Bear Creek

Galena Creek

Silver Creek

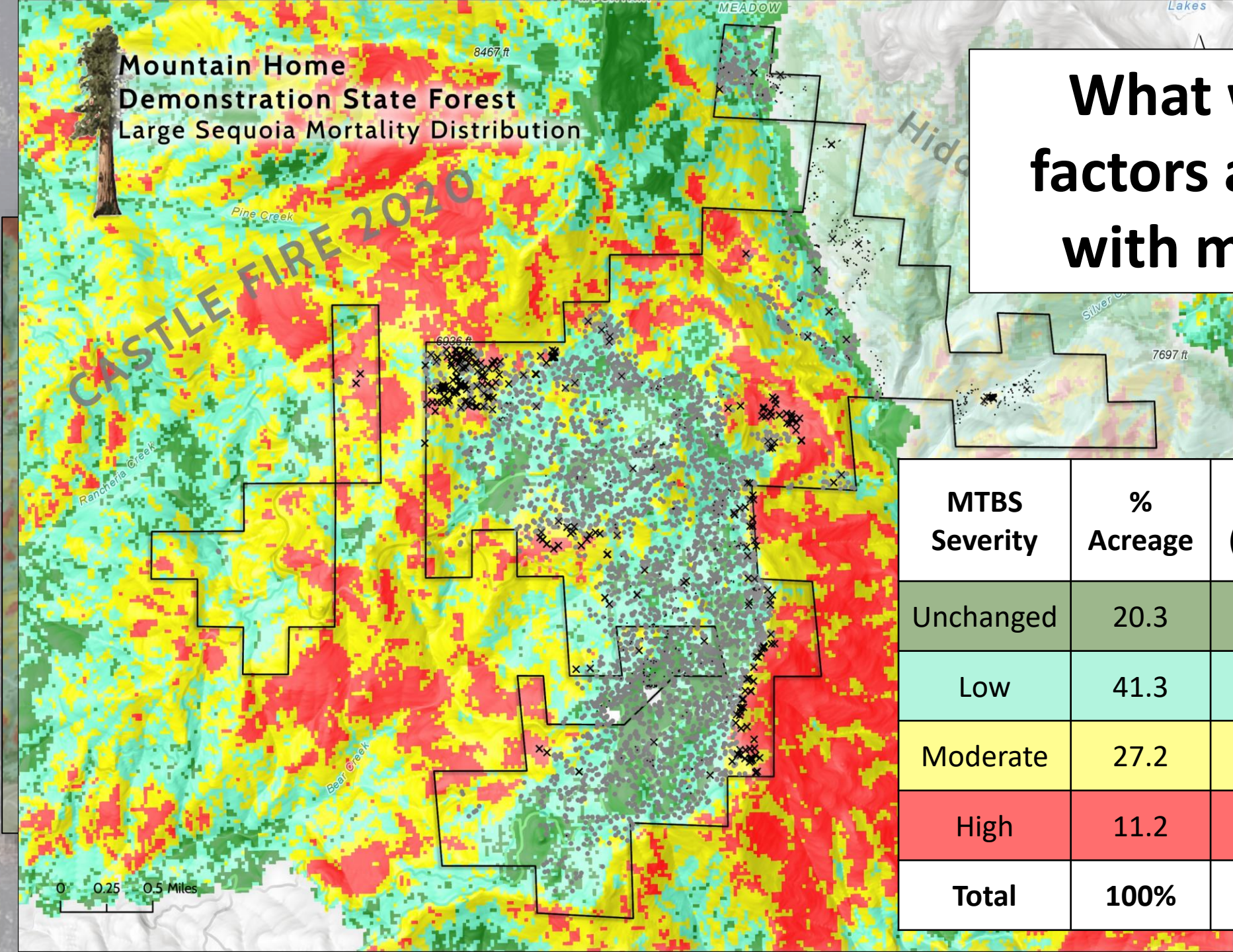
MEADOW

Lakes



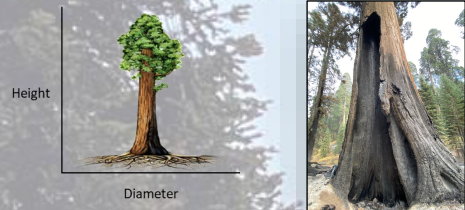
Mountain Home
 Demonstration State Forest
 Large Sequoia Mortality Distribution

What were the factors associated with mortality?



MTBS Severity	% Acreage	# of trees (killed/Total)	% Mortality
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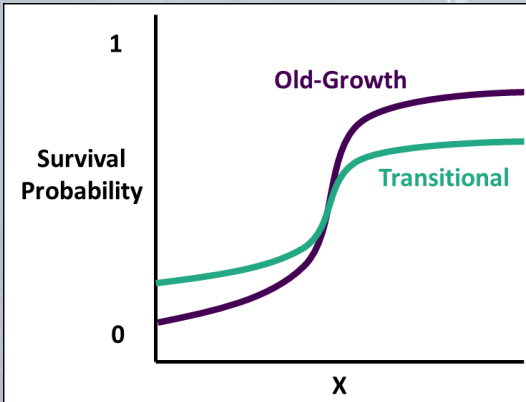
Tree characteristics



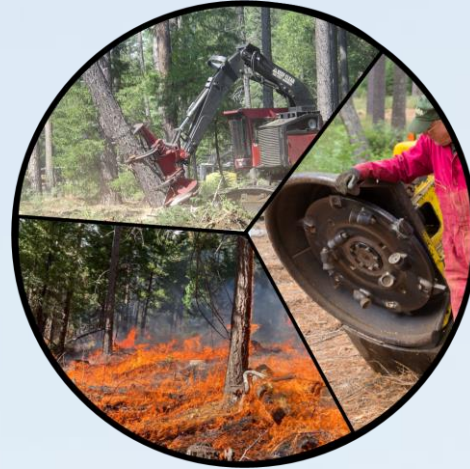
Topography



Question 1: Which tree and topographic variables were predictive of survival in recently untreated areas?



Treatment History



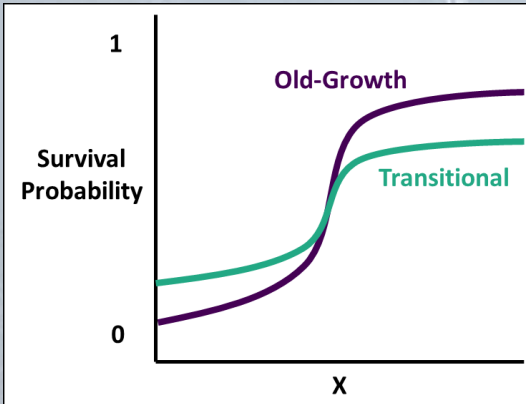
Tree characteristics



Topography



Question 1: Which tree and topographic variables were predictive of survival in recently untreated areas?



Question 2: How did recent treatment change outcomes?

Recent impacts to giant sequoia

Fire scar presence

Decreasing elevation

**Decreasing pre-fire
live crown ratio**

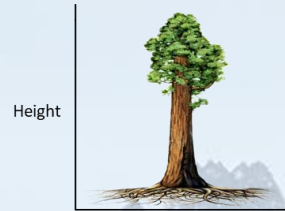


Predictors of survival in recently untreated areas

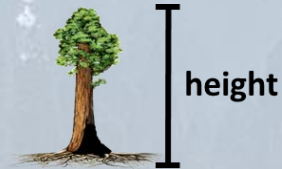
- +** Increased survival probability
- Decreased survival probability



Fire scar presence



Diameter
Height:Diameter Ratio



Transitional



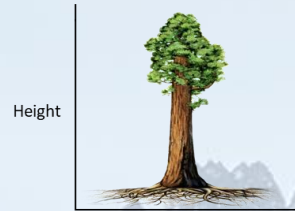
Old-Growth

Predictors of survival in recently untreated areas

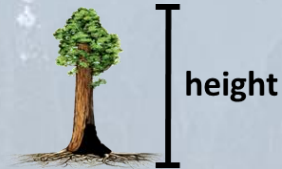
+ Increased survival probability
- Decreased survival probability



Fire scar presence



Height:Diameter Ratio



TPI



Transitional



Old-Growth

Predictors of survival in recently untreated areas

+ Increased survival probability
- Decreased survival probability



Fire scar presence



Height:Diameter Ratio



TPI



Transitional



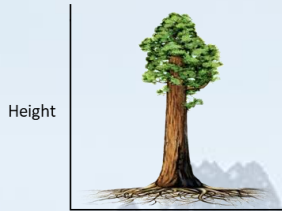
Old-Growth

Predictors of survival in recently untreated areas

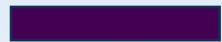
+ Increased survival probability
— Decreased survival probability



Fire scar presence



Height:Diameter Ratio



TPI

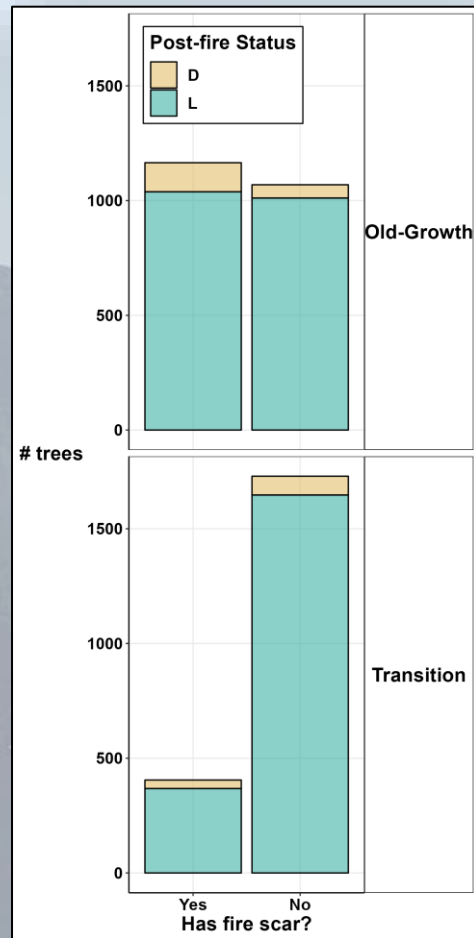


Transitional



Old-Growth

Mortality rate was double for trees with fire scars



Fire scar?

Yes

14% mortality

No

7.6% mortality

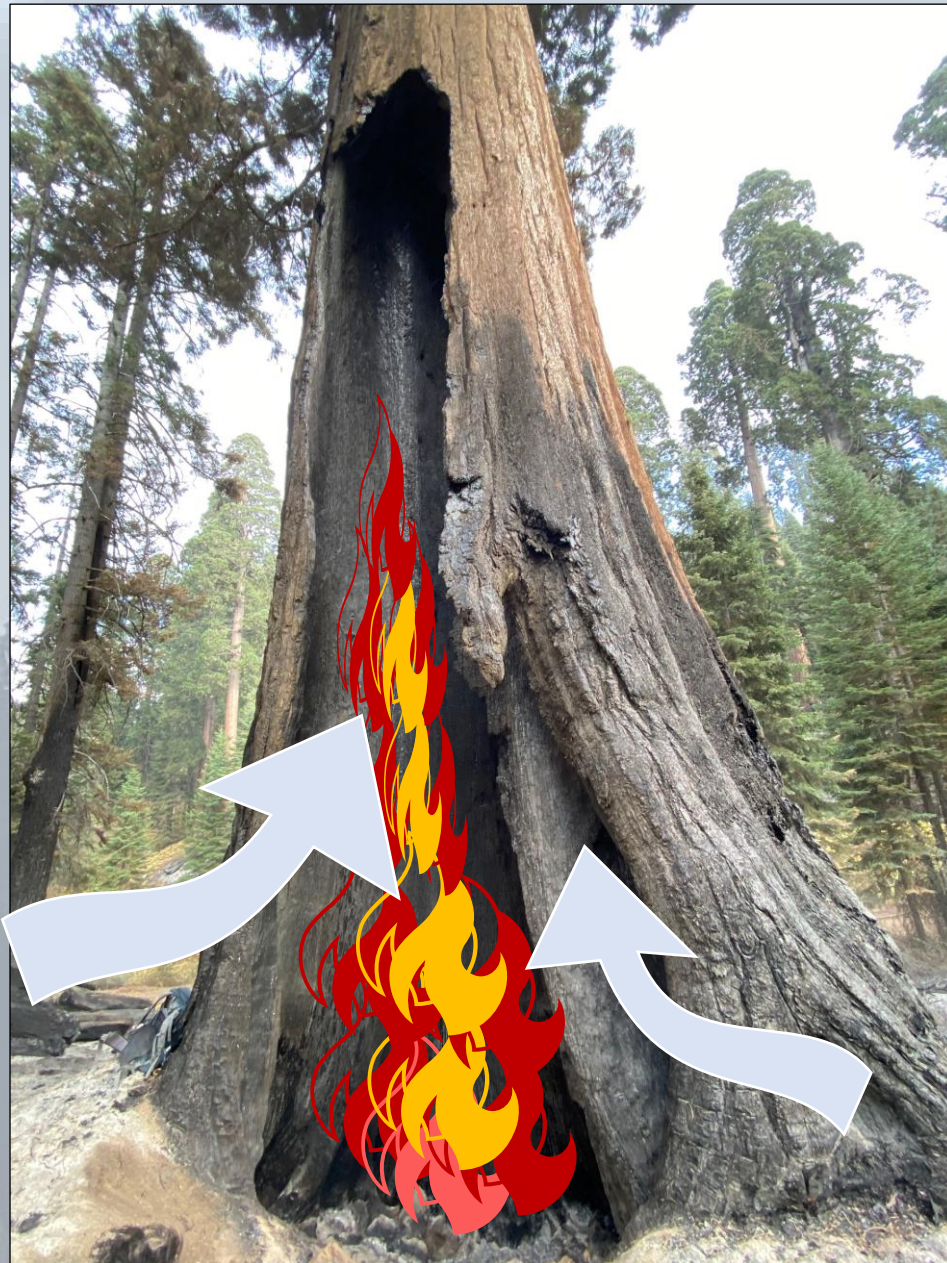
Fire scar?

Yes

11.7% mortality

No

6.1% mortality



Fuel accumulation

Optimized air flow

Consume conductive tissue

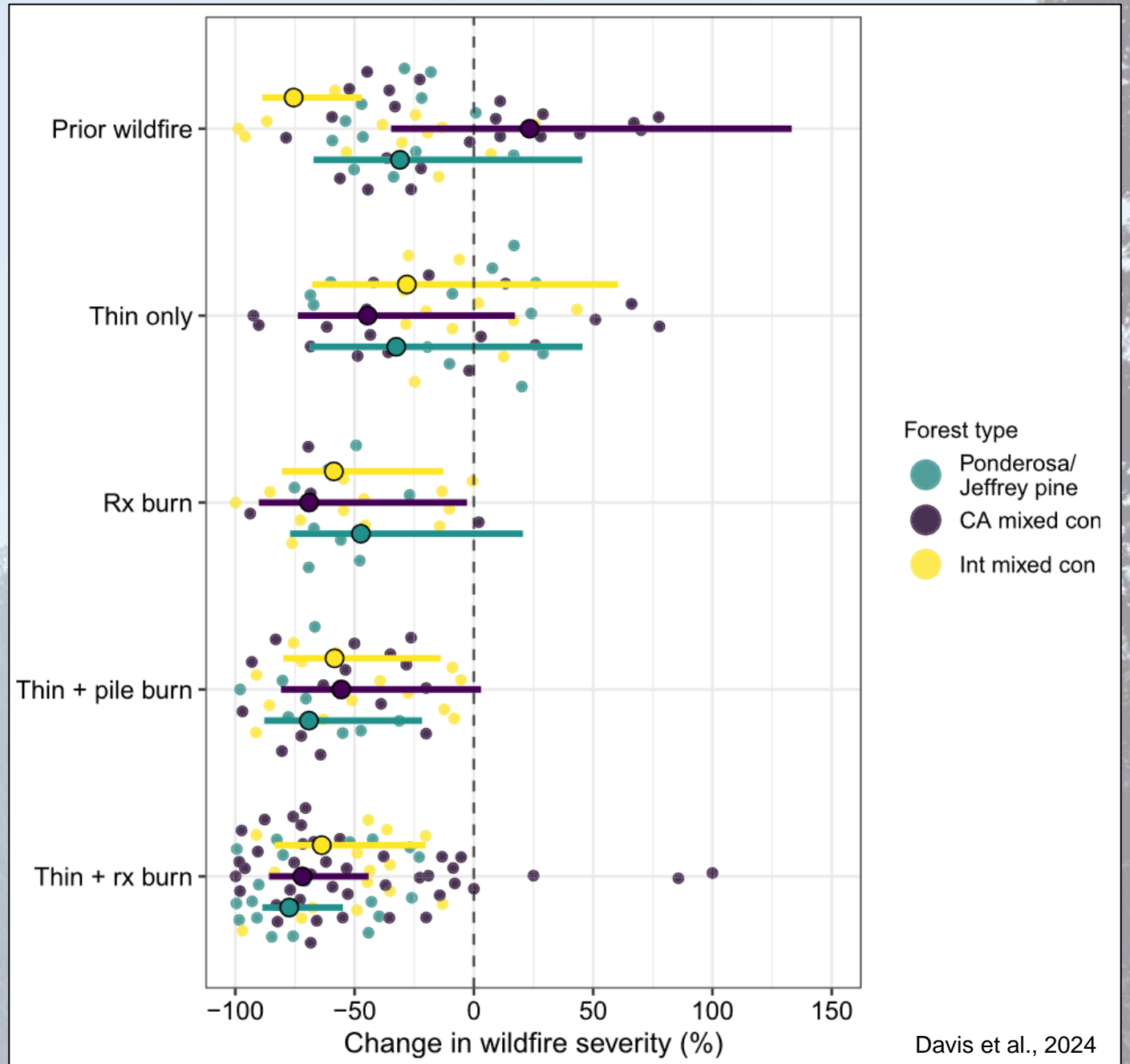
Structural failure



Question 2: Did treatments influence survival probability at MHDSF?

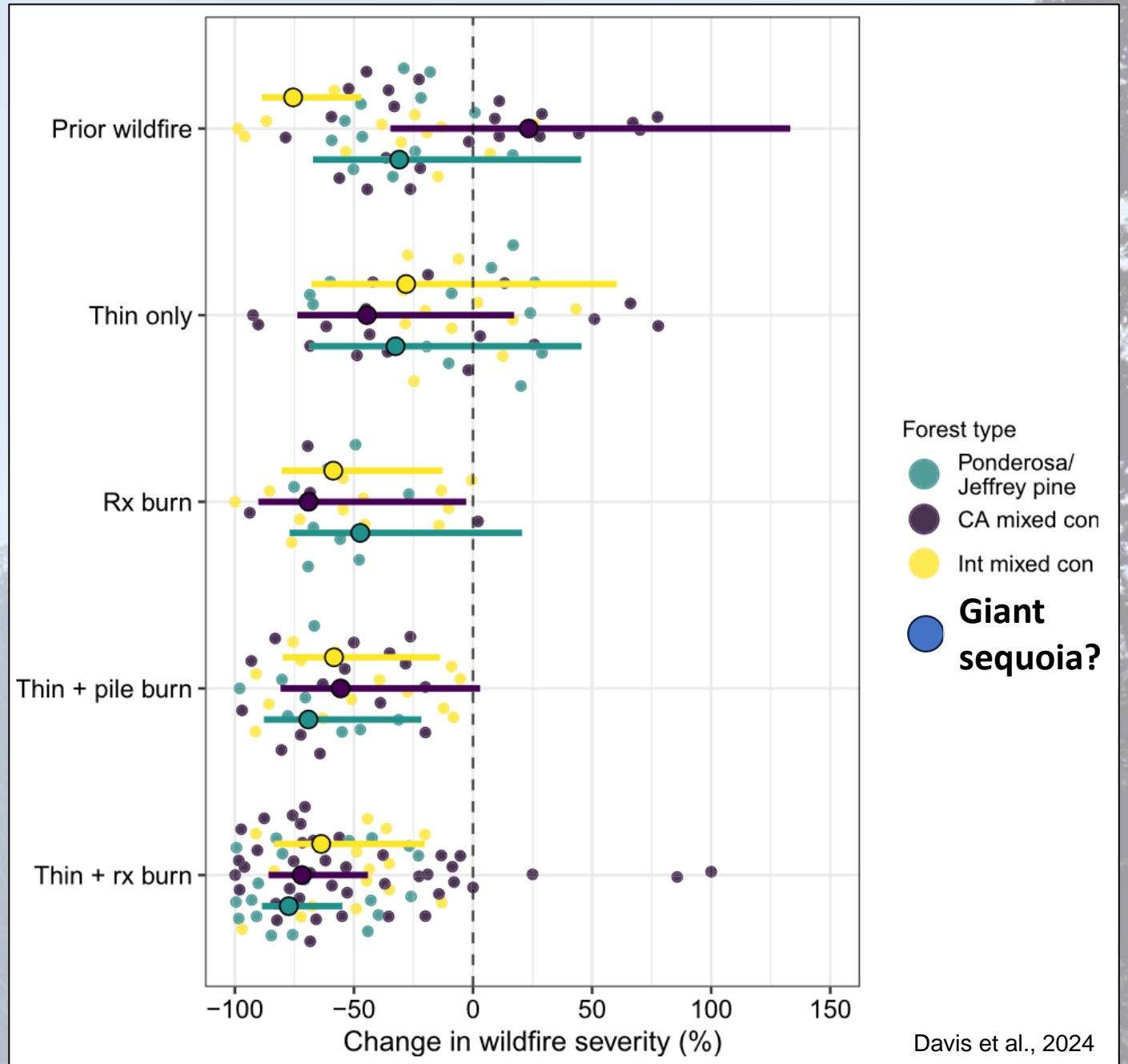
In other frequent-fire forest types...

Treatments work



In other frequent-fire forest types...

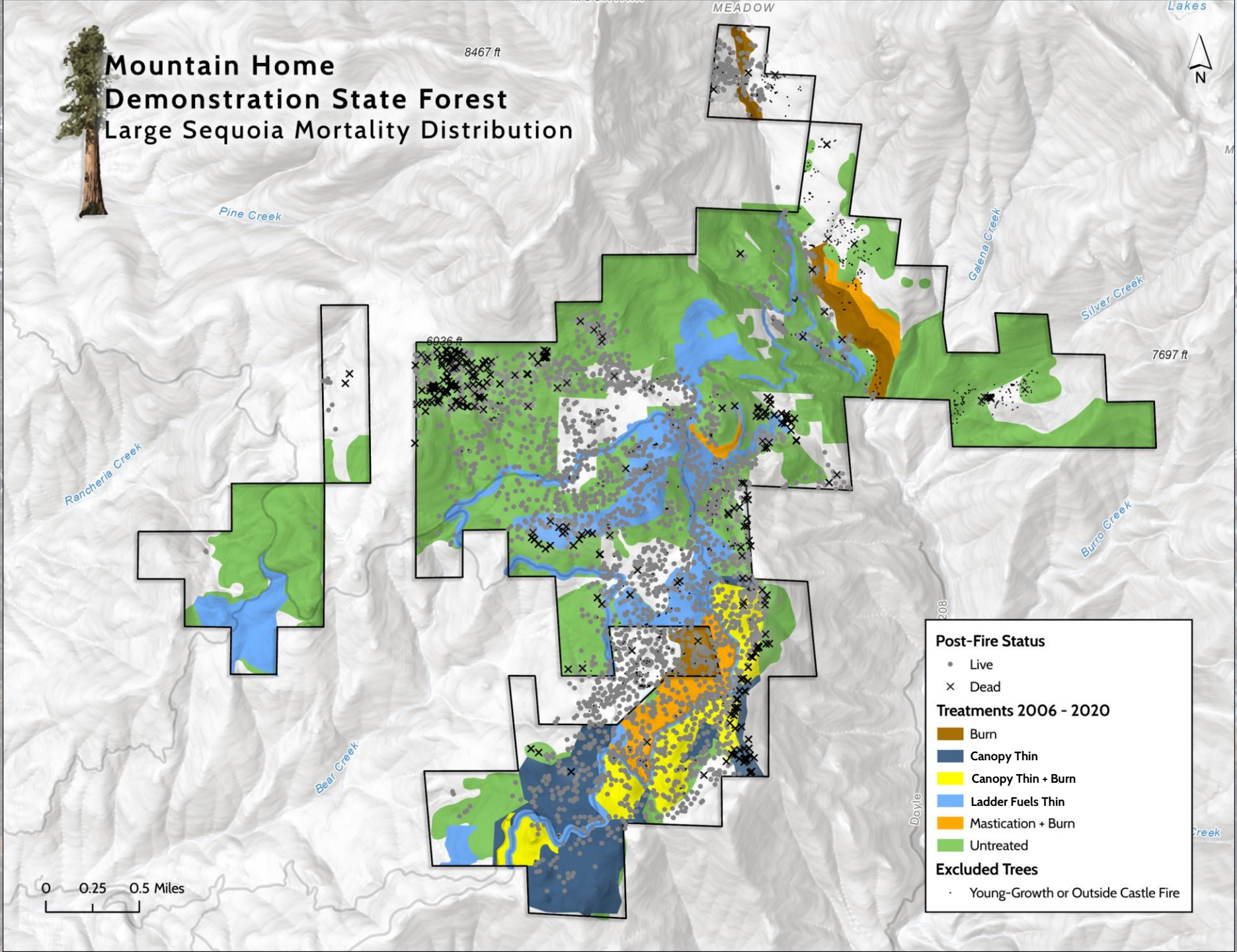
Treatments work





Mountain Home Demonstration State Forest Large Sequoia Mortality Distribution

8467 ft



0 0.25 0.5 Miles

Post-Fire Status

- Live
- × Dead

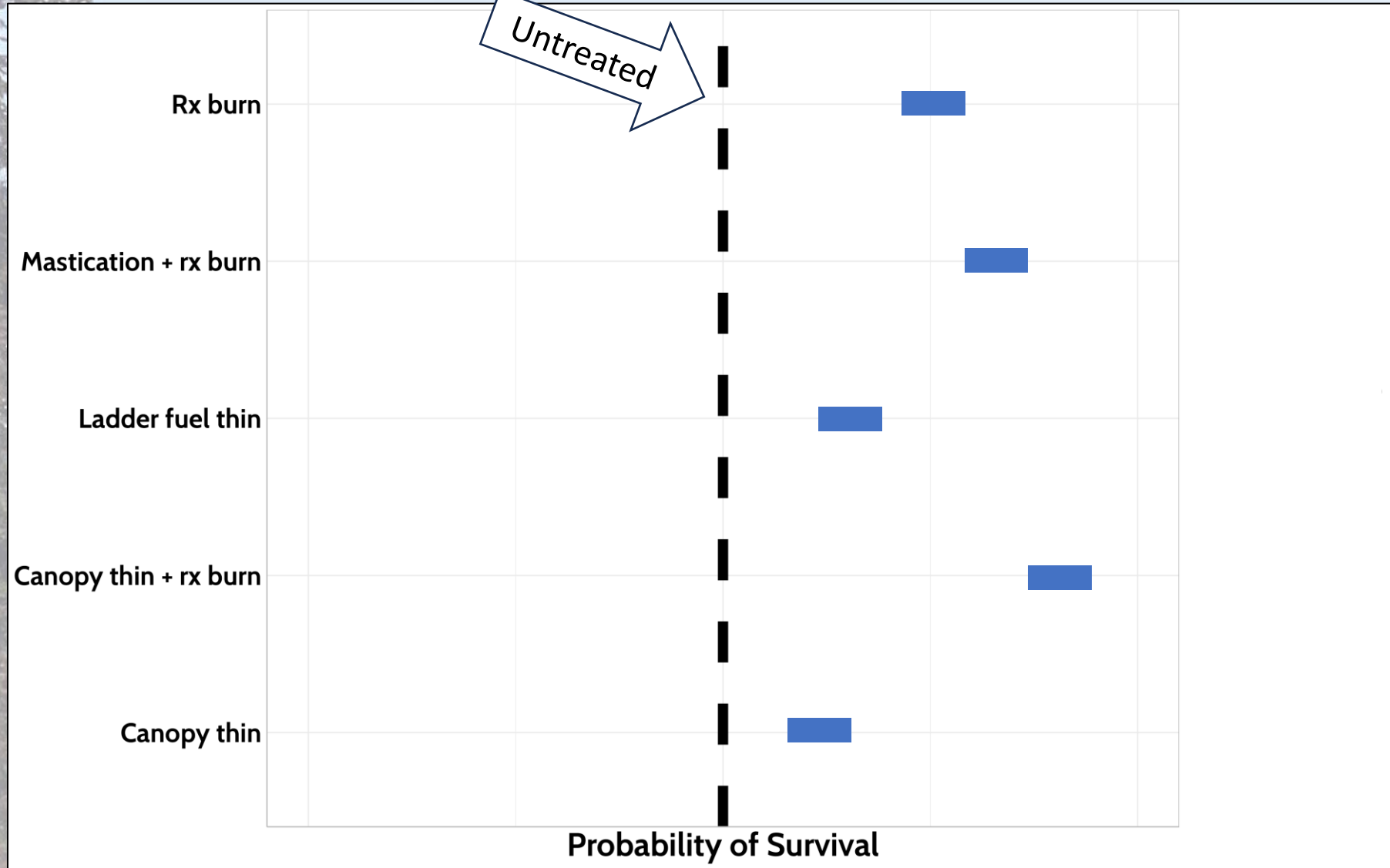
Treatments 2006 - 2020

- Burn
- Canopy Thin
- Canopy Thin + Burn
- Ladder Fuels Thin
- Mastication + Burn
- Untreated

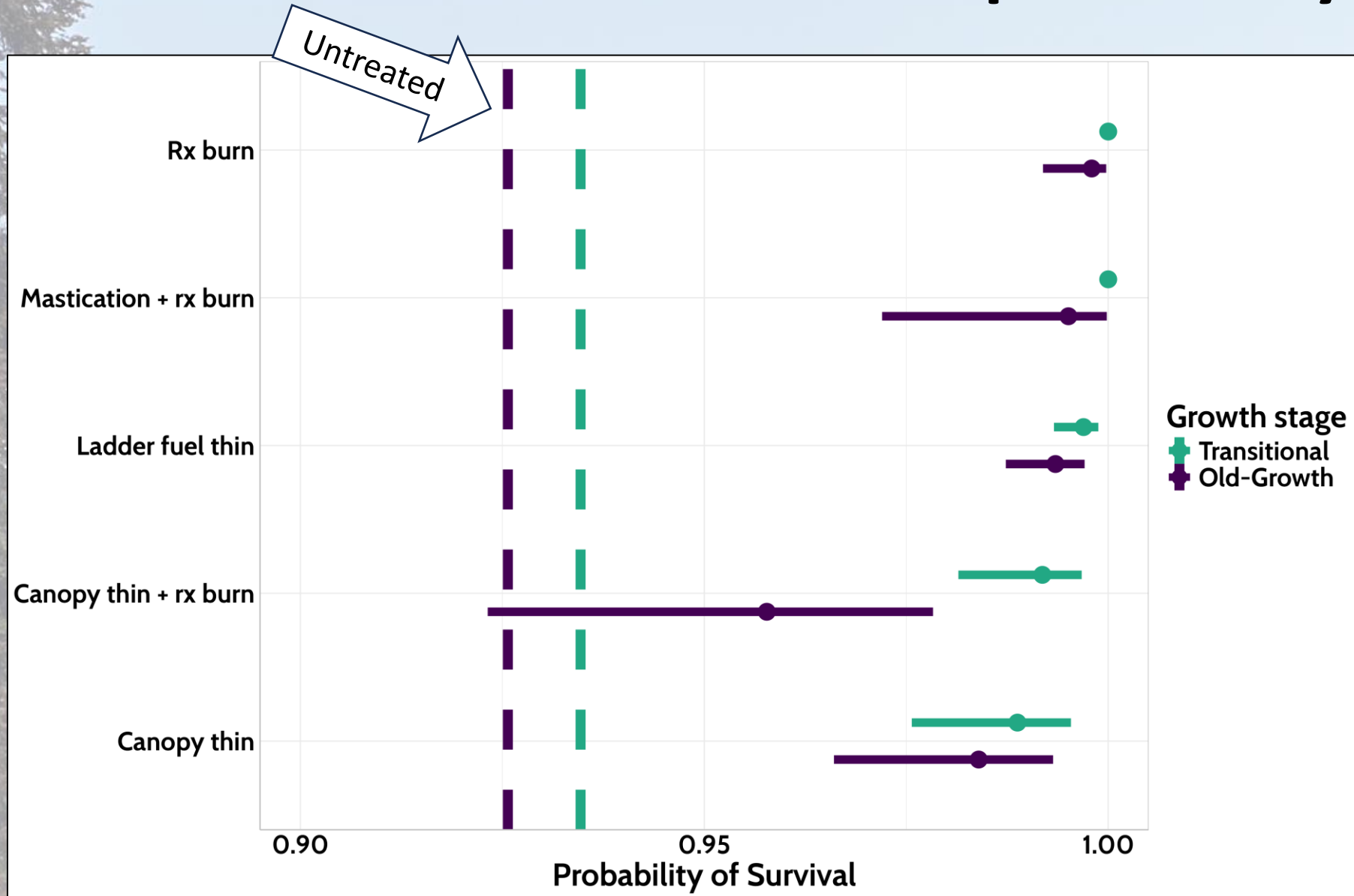
Excluded Trees

- Young-Growth or Outside Castle Fire

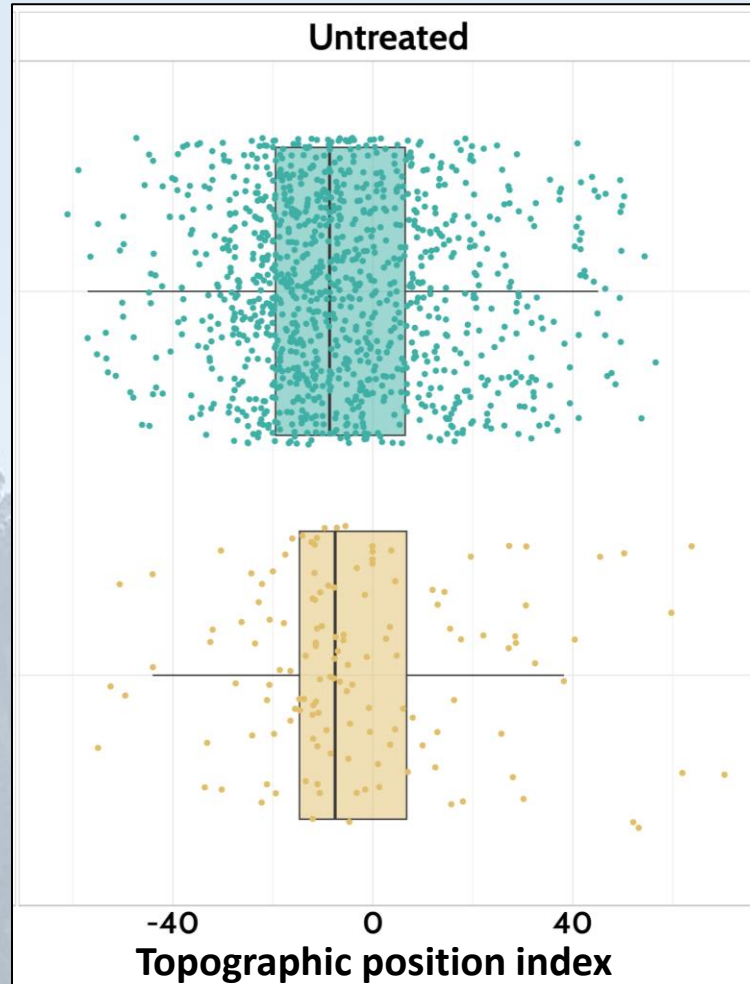
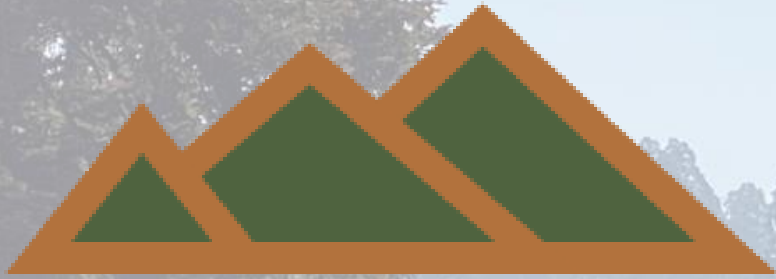
Expectations



Treatments increase survival probability



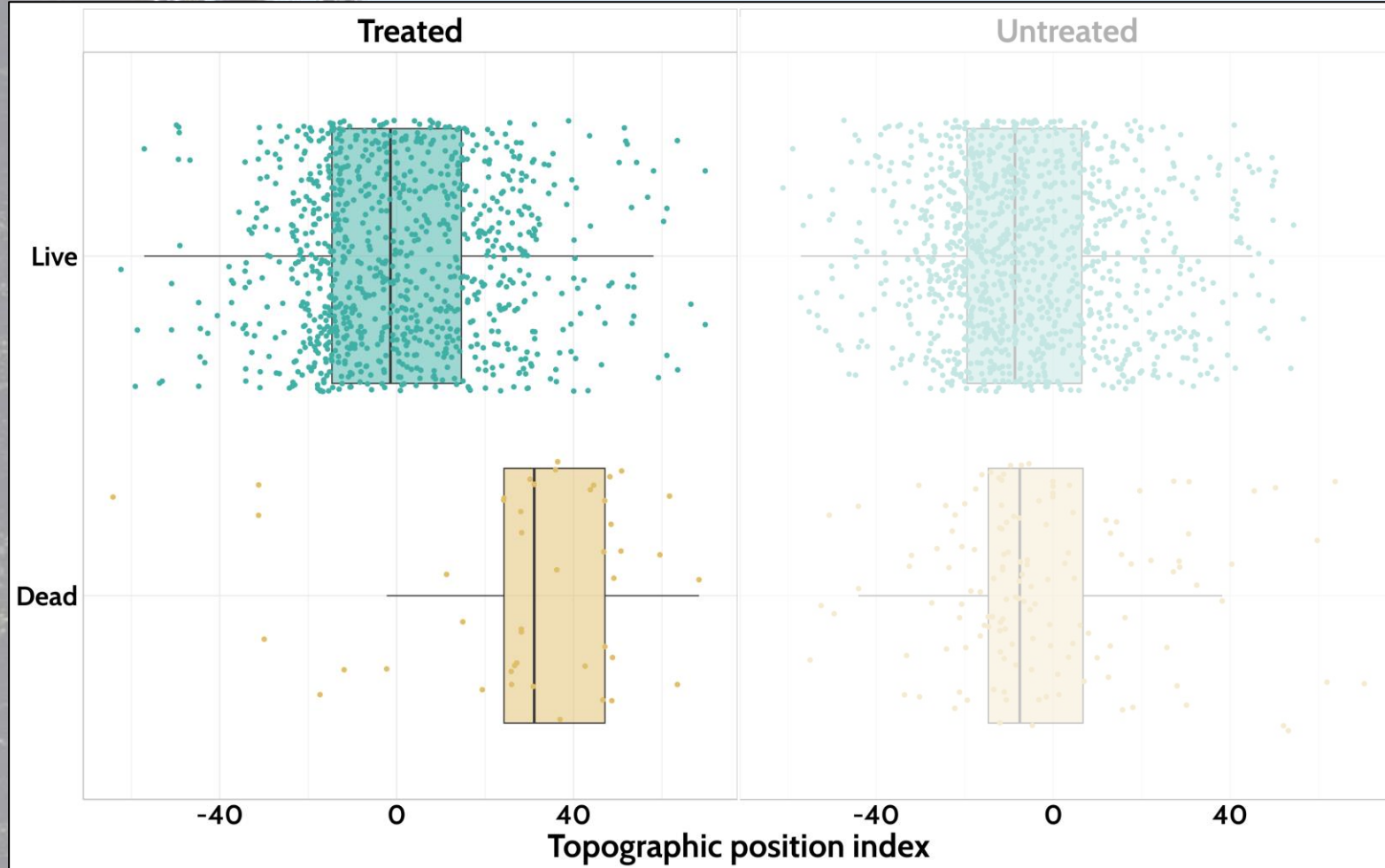
Topographic position



No recent treatment...

Fuels override effect of
topography

Topographic position



No recent treatment...

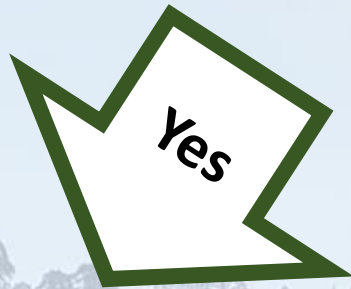
Fuels override effect of topography

With recent treatment...

Topography can influence fire behavior because fuels are limited

Conclusions

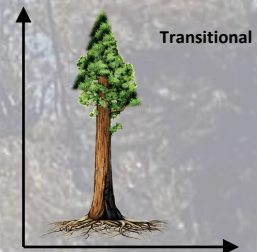
Can we do stand-level treatments?



Tree-level treatments could potentially be useful ("Point Protection")

What informs vulnerability?

TPI



Questions?



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