

# Mortality and recovery following extreme drought in California

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# Density reduction treatments

Mechanical thinning, prescribed fire, managed wildfire



# Study questions

How does pre-drought density reduction influence...

- mortality patterns?
- recovery potential?

# Study design

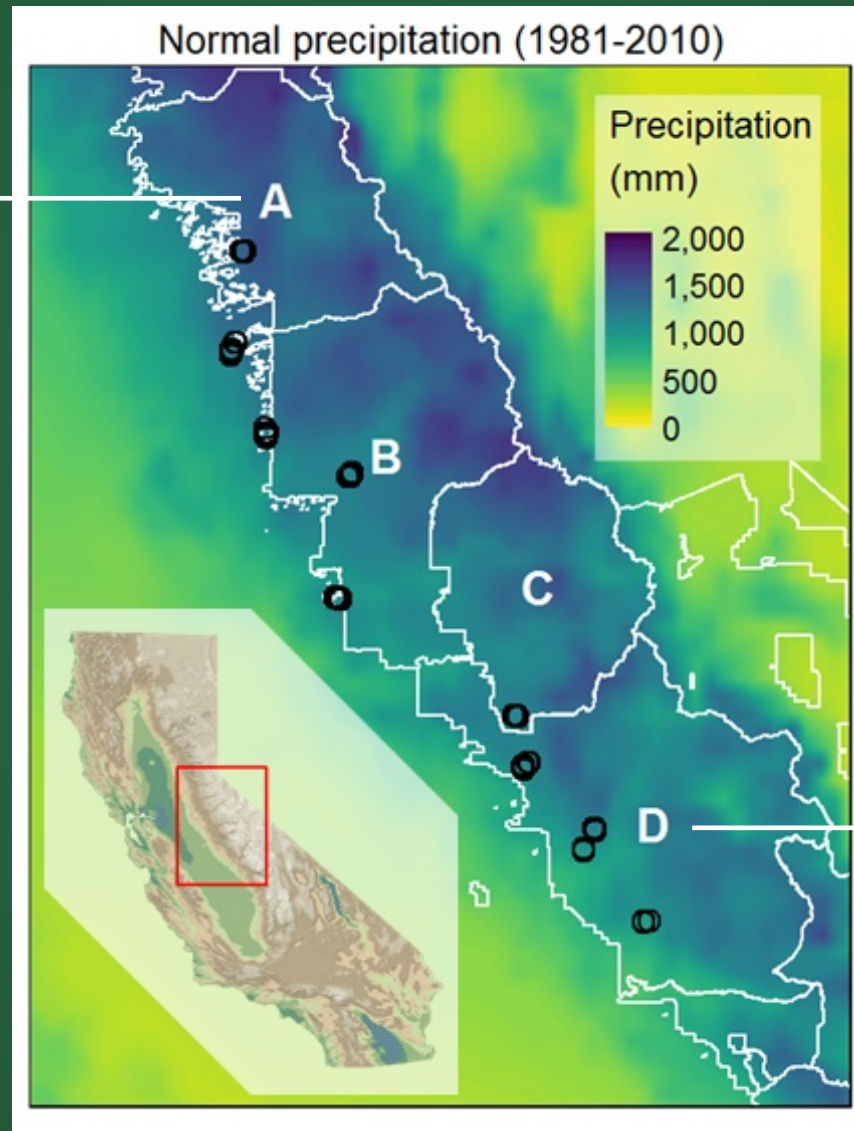
- Paired treated\* vs. untreated stands
- Sampled 10 sites, 158 plots total (1/8 acre ea)
- Plot data collected 2017
- Three National Forests and Yosemite NP
  - Ponderosa pine and dry mixed conifer forests



\*Mechanical thinning and/or prescribed burning (one or multiple entries)

# Study plots

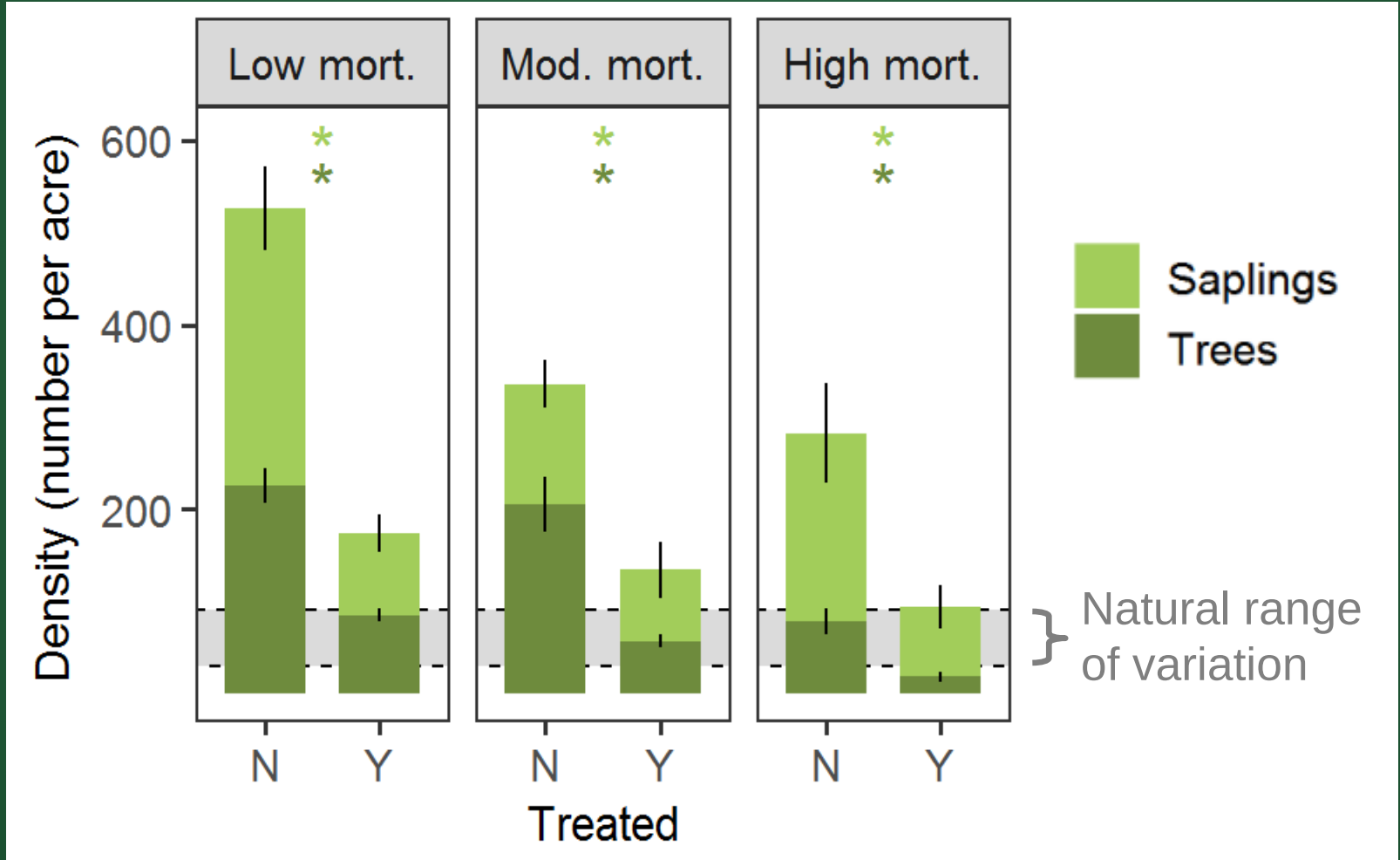
Eldorado NF



Sierra NF

# Post-drought stand density

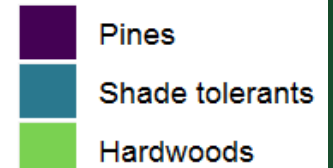
Mortality extent: 0-33%      33-67%      67-100%      by basal area



# Species composition

In high-mortality areas

Species group



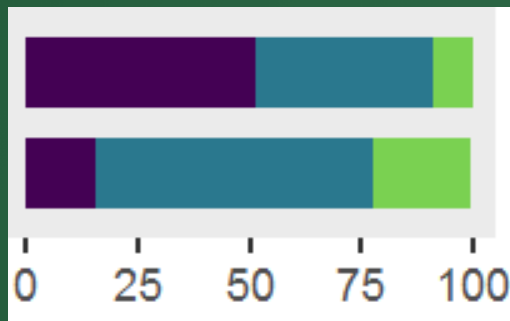
## Trees

Untreated

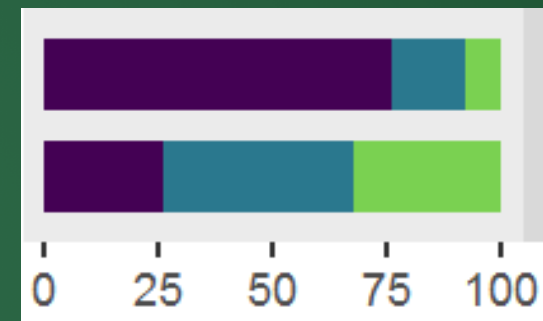
Treated

Pre-drought

Post-drought



Relative abundance (%)



Relative abundance (%)

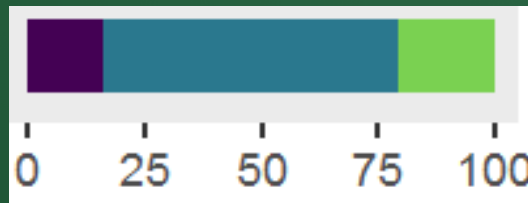
## Regeneration

(Saplings + seedlings)

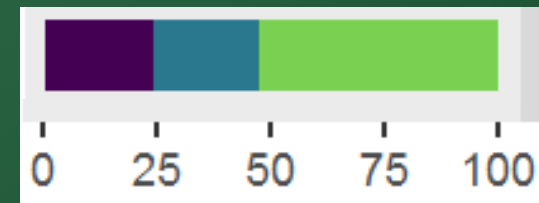
Untreated

Treated

Post-drought



Relative abundance (%)



Relative abundance (%)

# Future forests?

## Severe drought in an untreated stand

- High mortality
- Low-moderate overstory density
- Shade-tolerant overstory and regen.



## Severe drought in a treated stand

- Lower (but still high) mortality
- Low overstory density
- Hardwood-pine overstory and regen.

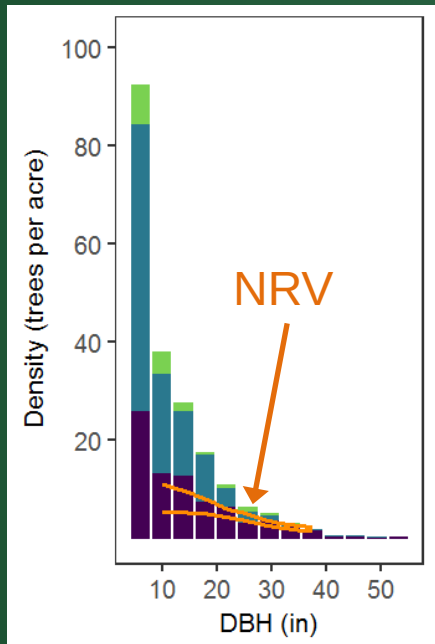




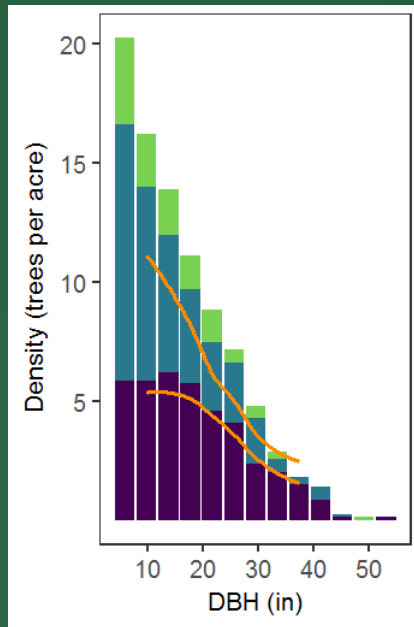
# Drought as a restoration treatment?

**NO**

Untreated, pre-drought

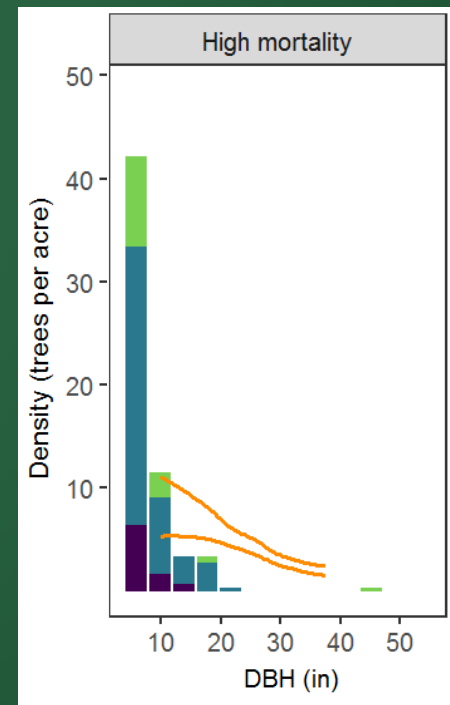


Treated, pre-drought

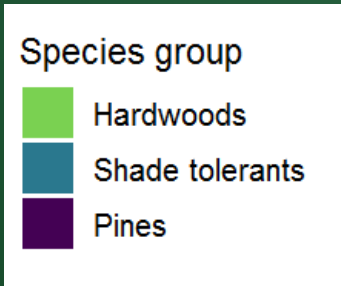


Treatment

Untreated, post-drought



Drought



# Acknowledgments

- Field crews & assistance
  - Chris Preston, Ruthie Schnitt, Julia Berkey, Sarah Russell
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Stand panoramas by Marc Meyer