Using Management to Increase Carbon Stability in Fire-prone Forests

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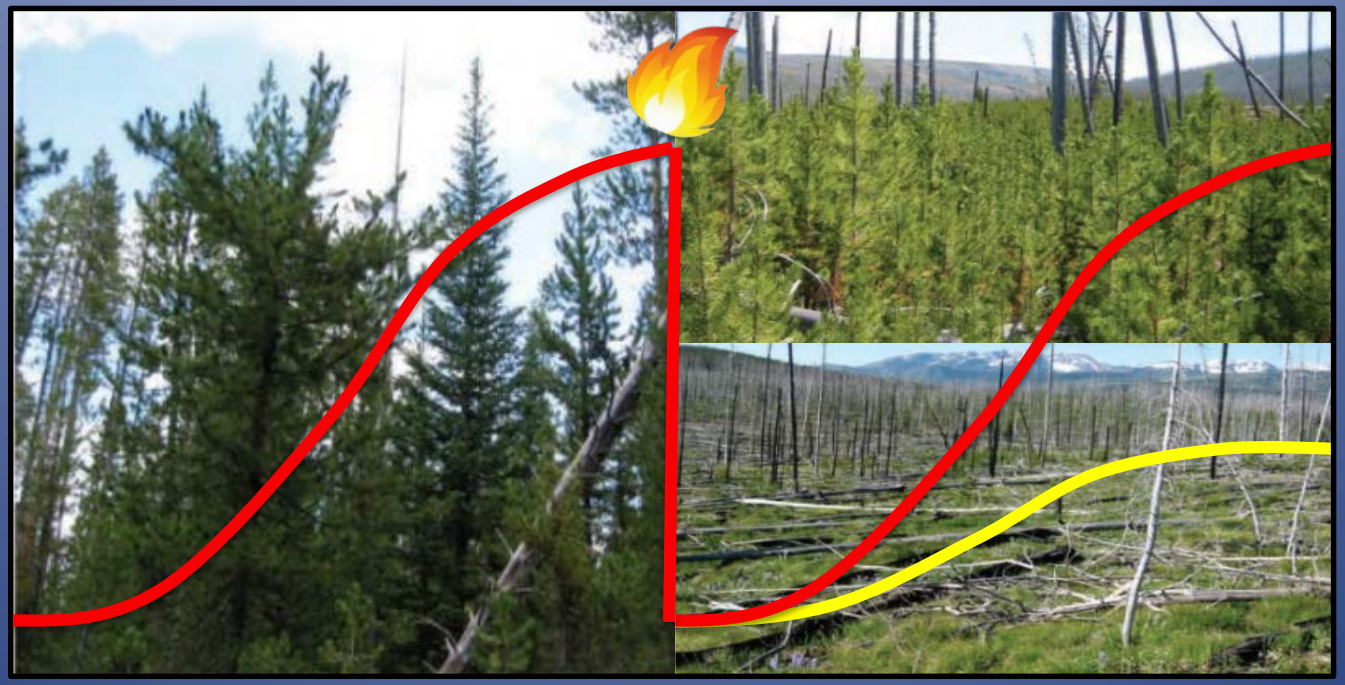
Main Points

- Management has near-term C costs
- In dry forests, treatments that reduce risk:
  - Stabilize C
  - Lower wildfire emissions
  - Achieve higher long-term C storage

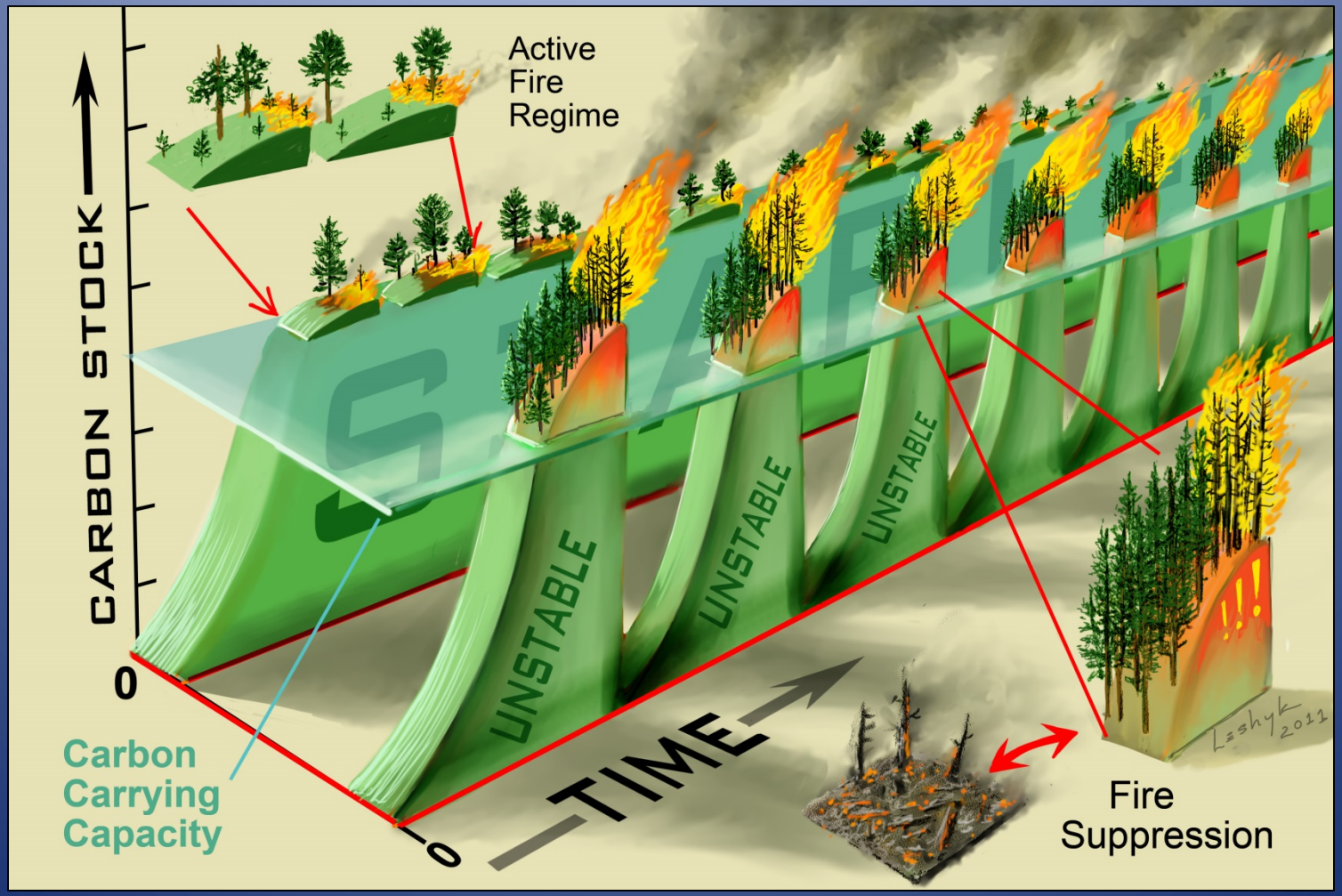
Carbon Carrying Capacity



A legacy of fire suppression

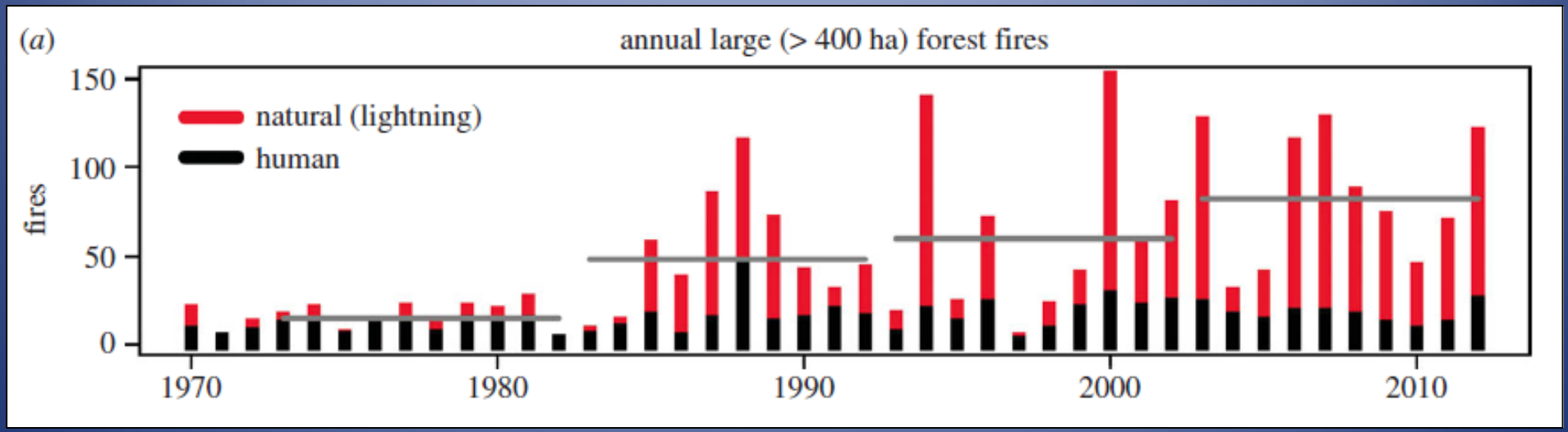
Larger, hotter wildfires

Fire-exclusion and CCC



Hurteau 2013

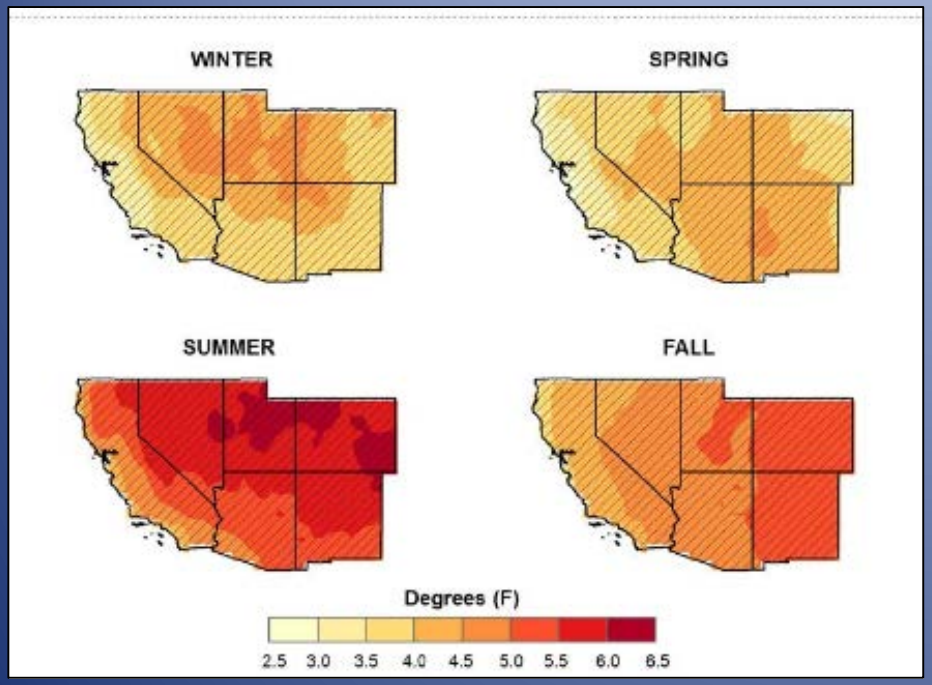
Decadal Wildfire Increase

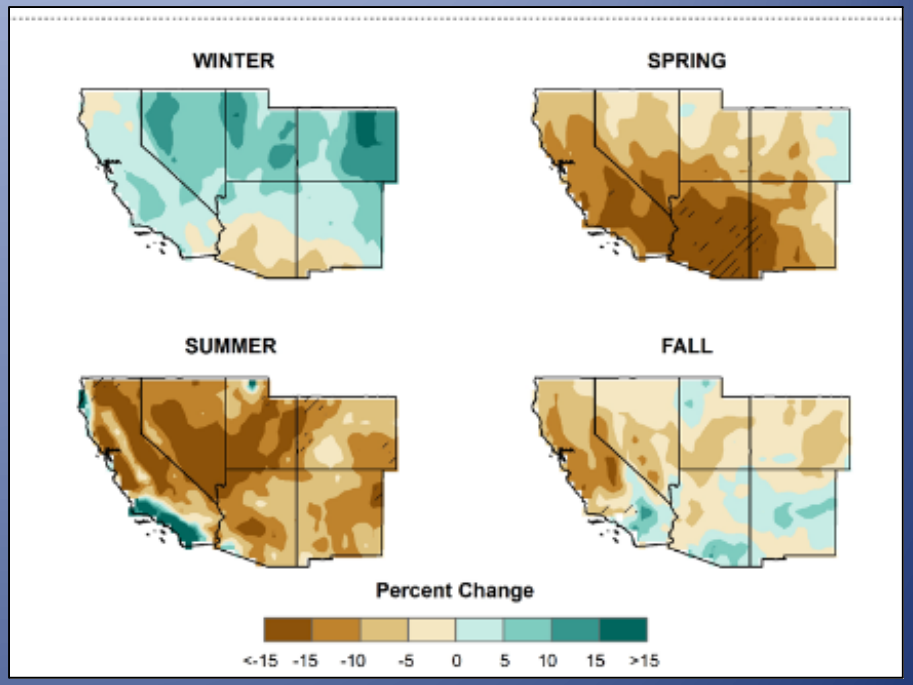


Sierra Nevada	+274%
Southwest	+462%

Westerling (2016)

Climate Change = Hotter & Drier



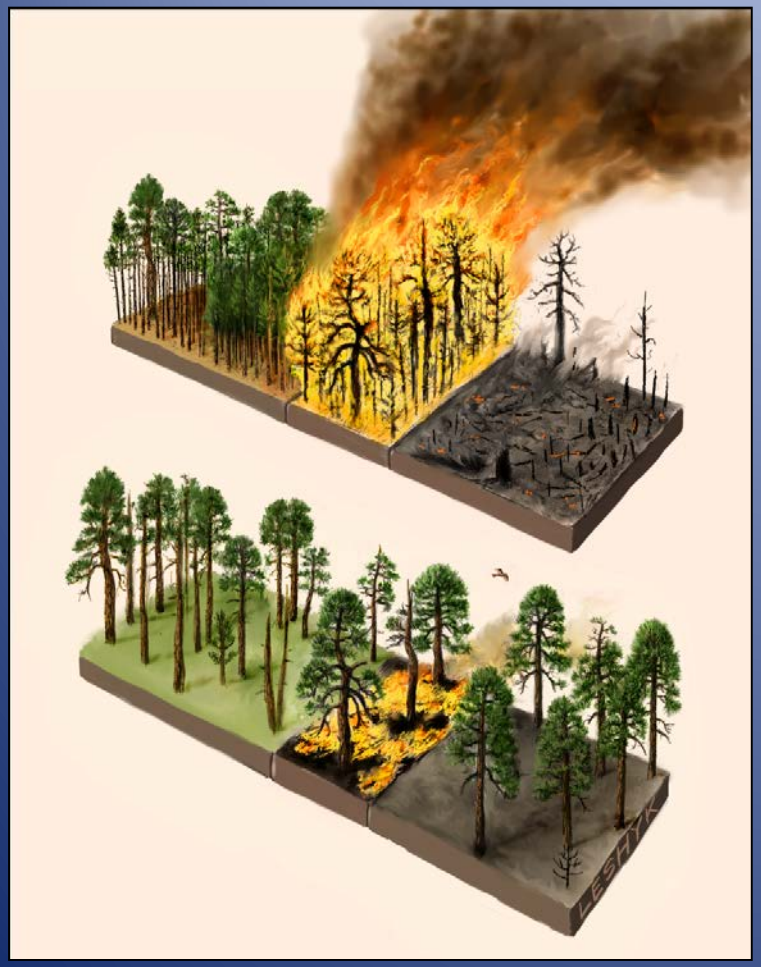


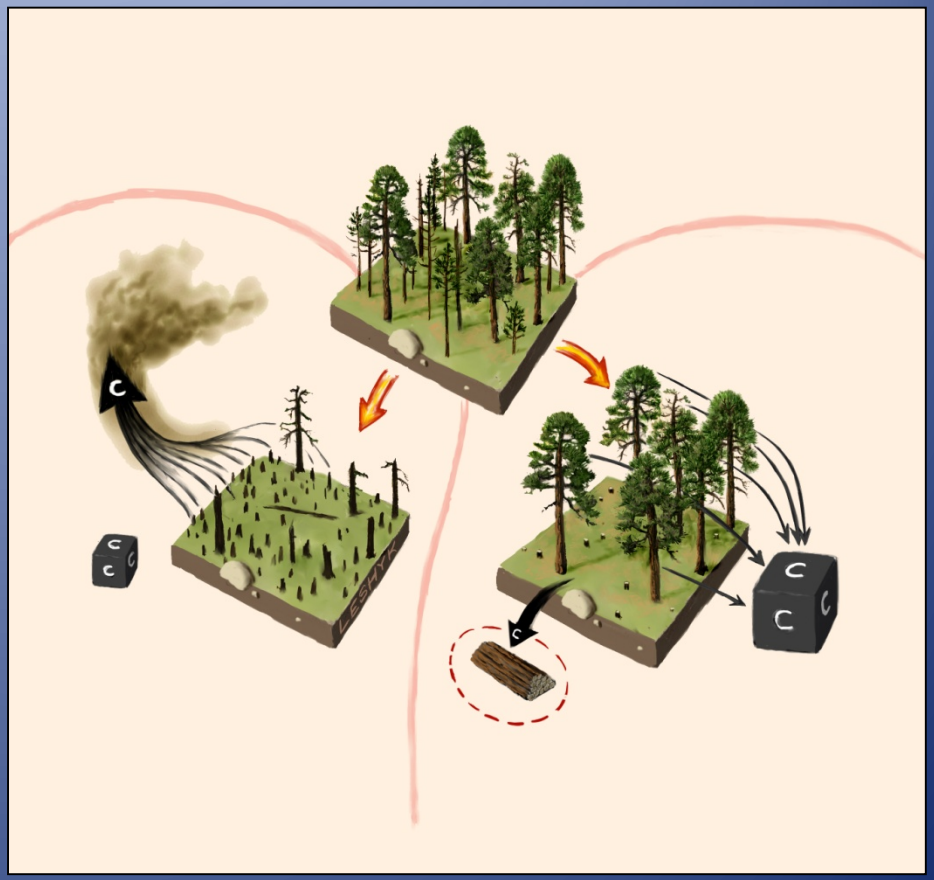
5-6°F increase in summer temperature

3-15% decrease in summer precipitation

NOAA Technical Report NESDIS 142-5

The Fire & Climate Challenge



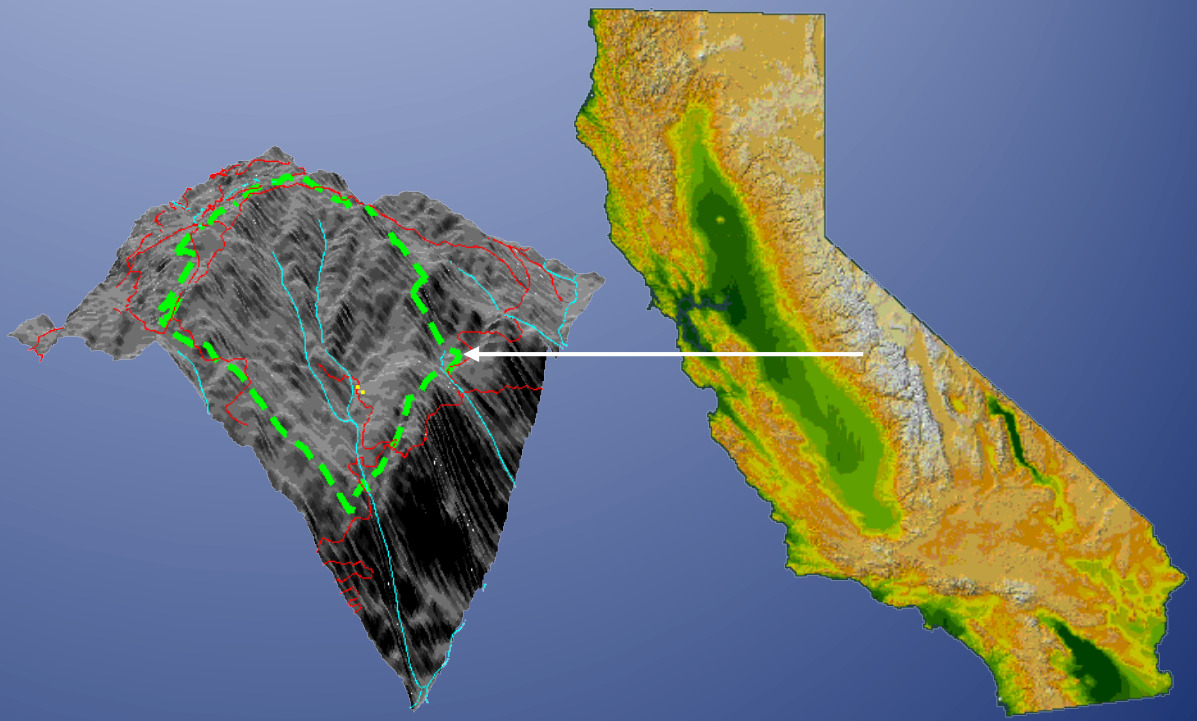


Hurteau et al. 2008

C Carrying Capacity Questions

- Treatment effects on C?
- Climate x Wildfire x Restoration effects on C?

The Teakettle Experiment



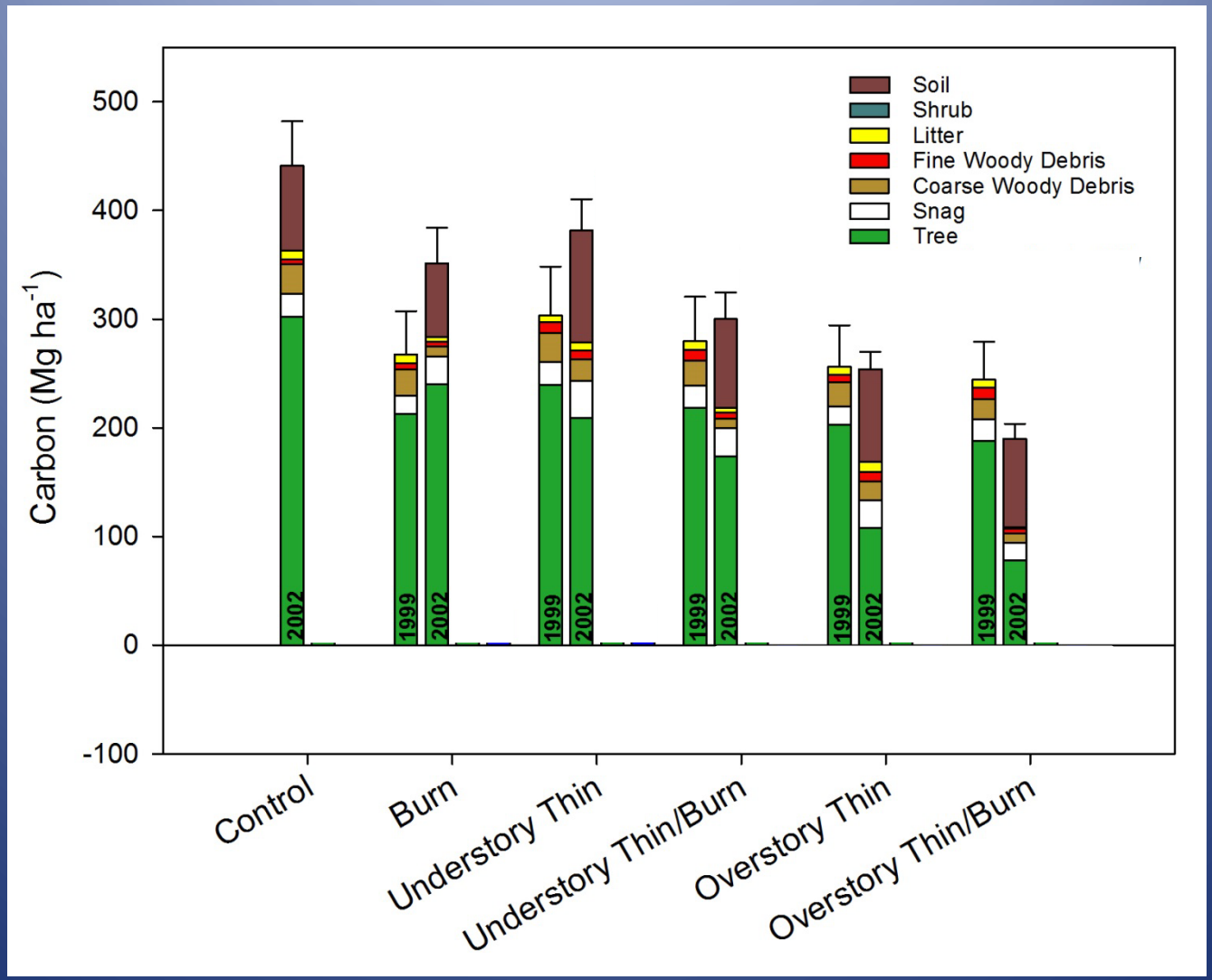
- 3 levels of thinning
- Crossed with burning

Overstory Harvest

Understory Thin + Burn

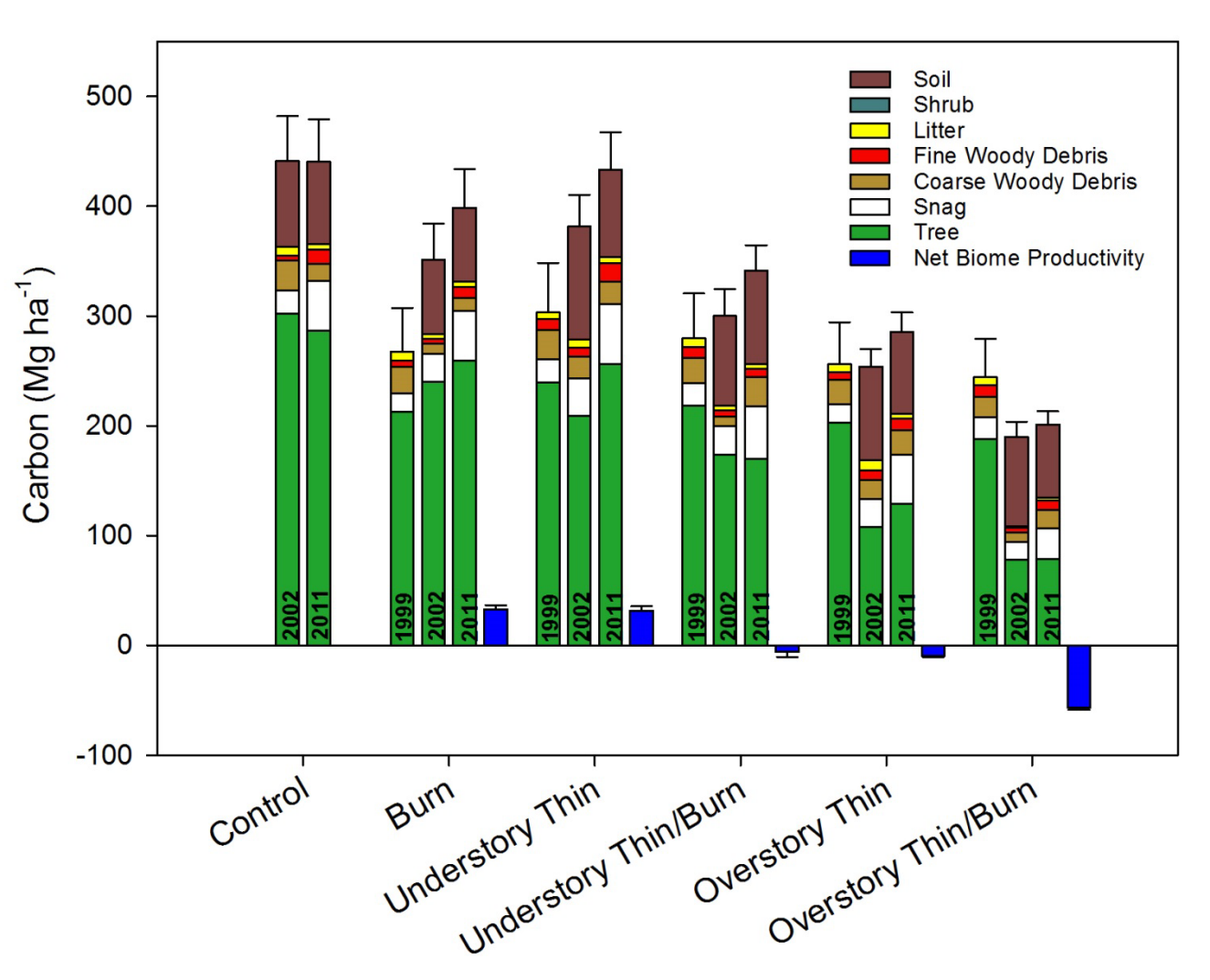
Burn Only

Treatments Incur a C Penalty



North et al. (2009), Wiechmann et al. (2015)

C Does Recover Over Time



Wiechmann et al. (2015)

Simulation Model: LANDIS-II

Forest Inventory

US Forest Service

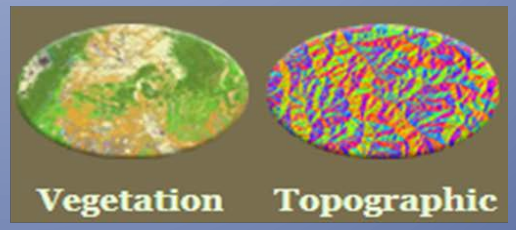
Soil Survey

SSURGO soil map

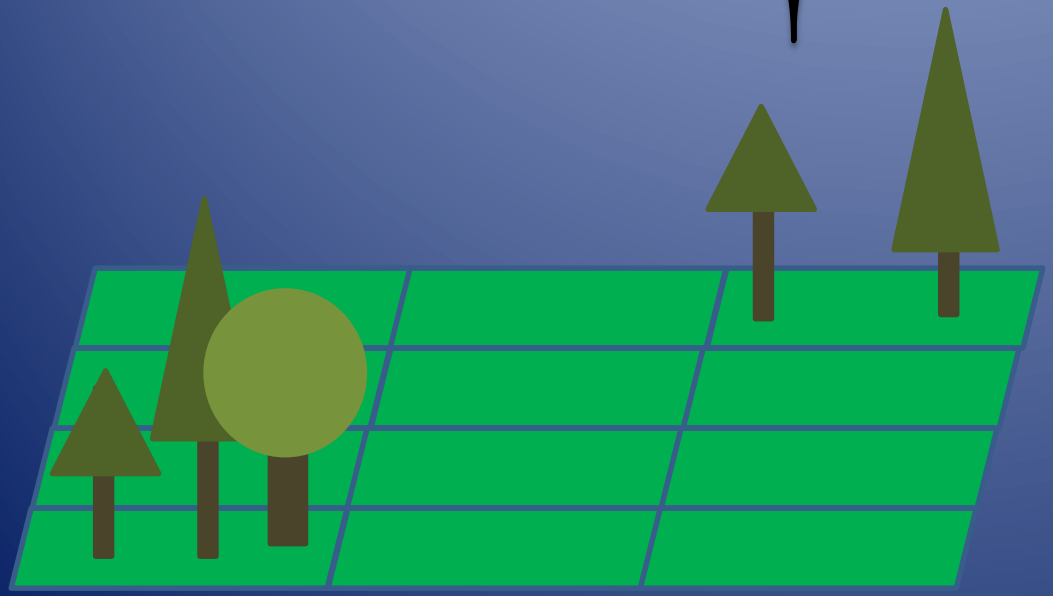
Species traits

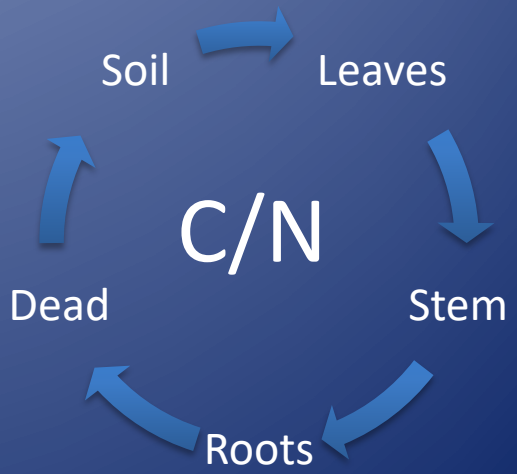
Life history, Physiology

Spatial layers



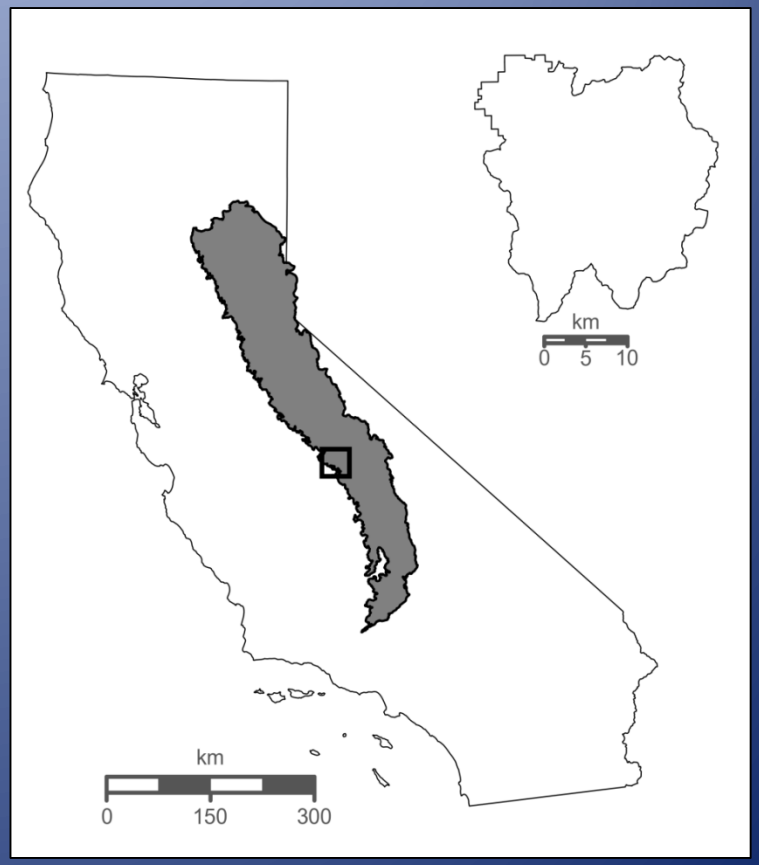
LANDFIRE 2010 Existing vegetation type





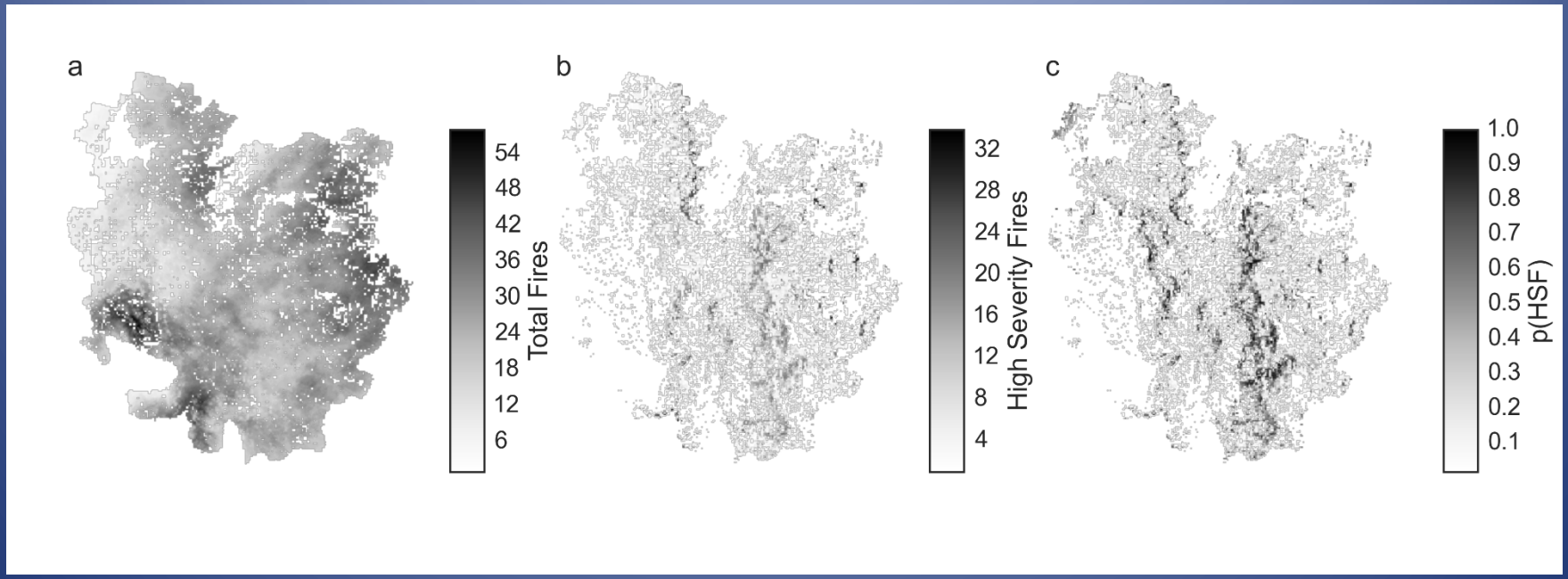
Dinkey Creek

- 4 Climate models
- High emissions (RCP 8.5)
- Treatments:
  - No-management
  - Naïve
  - Optimized



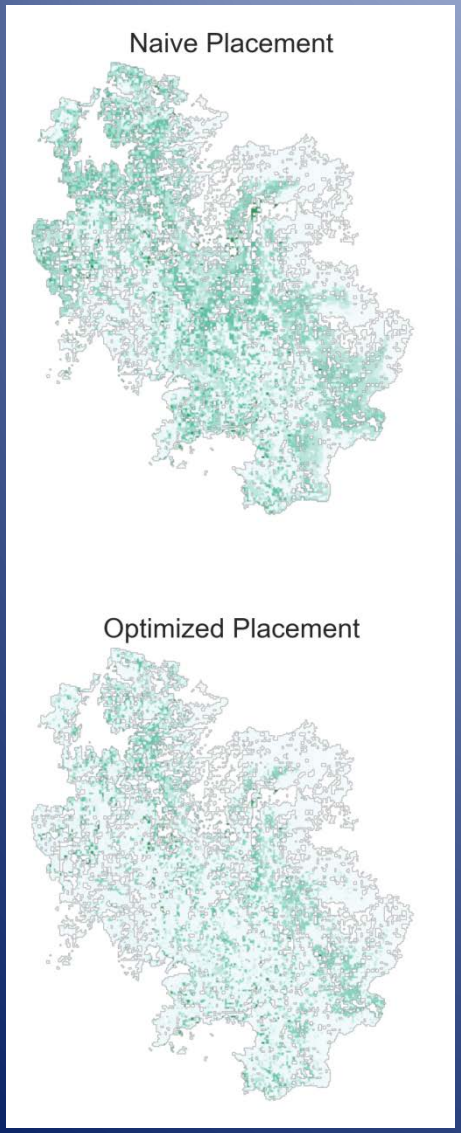
Krofcheck et al. (2018)

Determining Optimal Placement

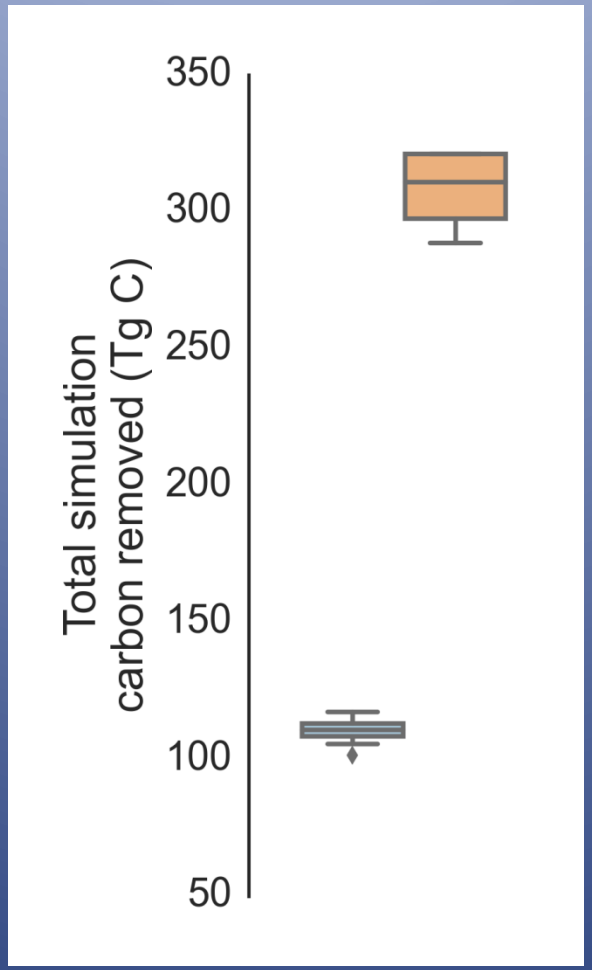


Krofcheck et al. (2018)

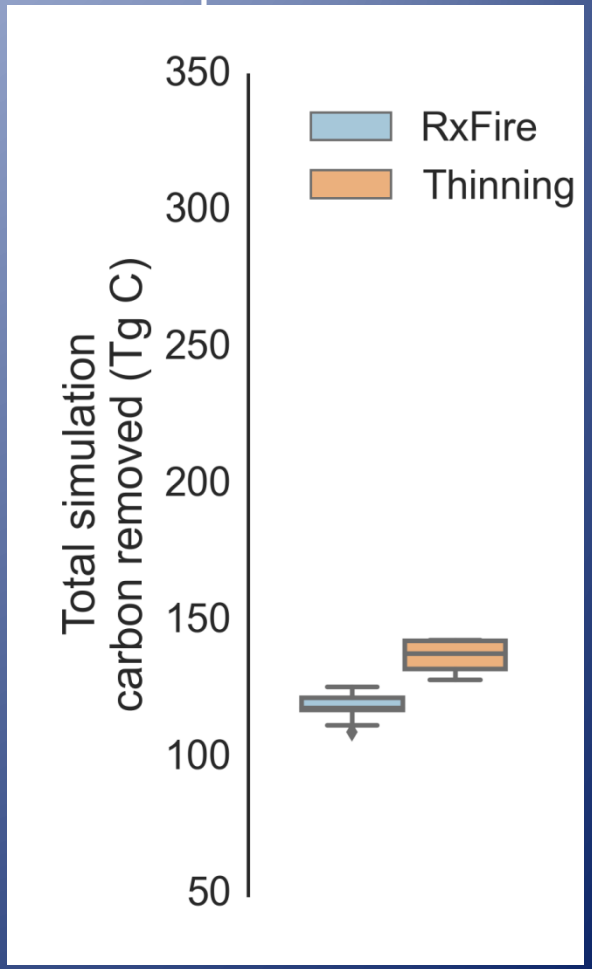
Optimized = lower thinning losses



Naive

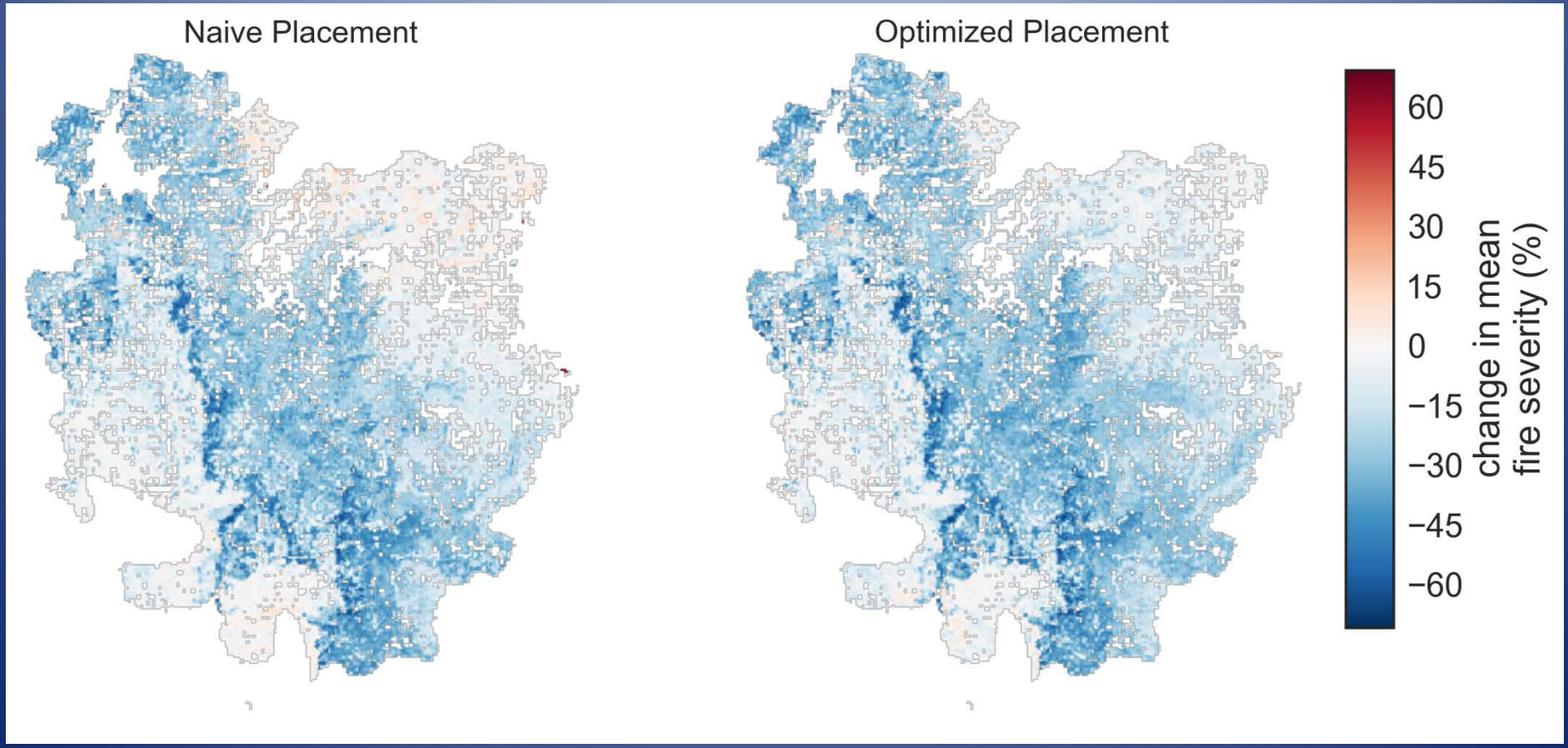


Optimized



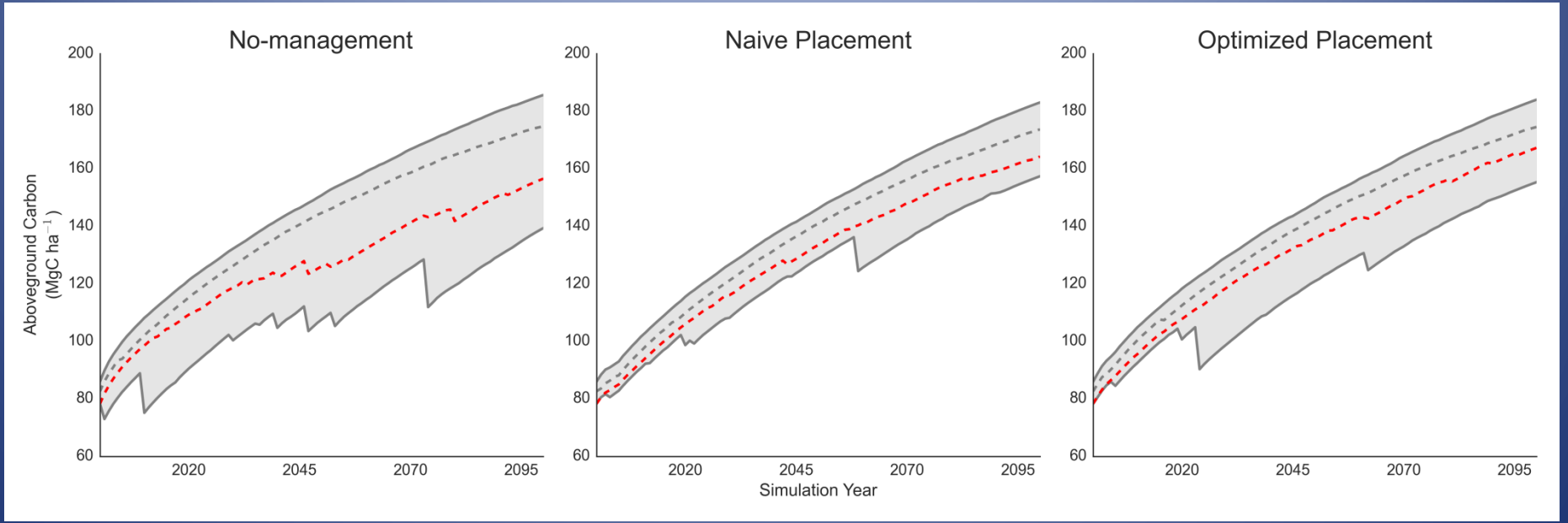
Krofcheck et al.

Fire severity reduction is equal



Krofcheck et al.

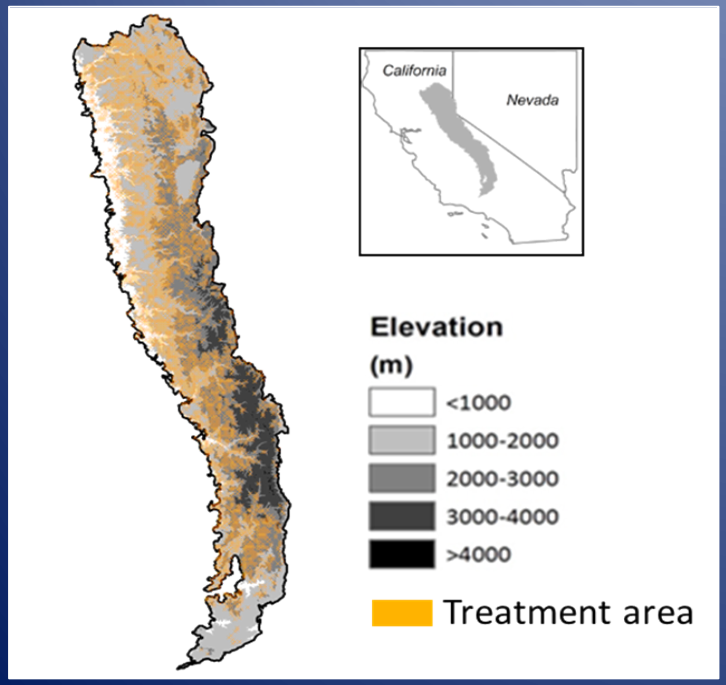
TEC: Planning for Extreme Events



Krofcheck et al.

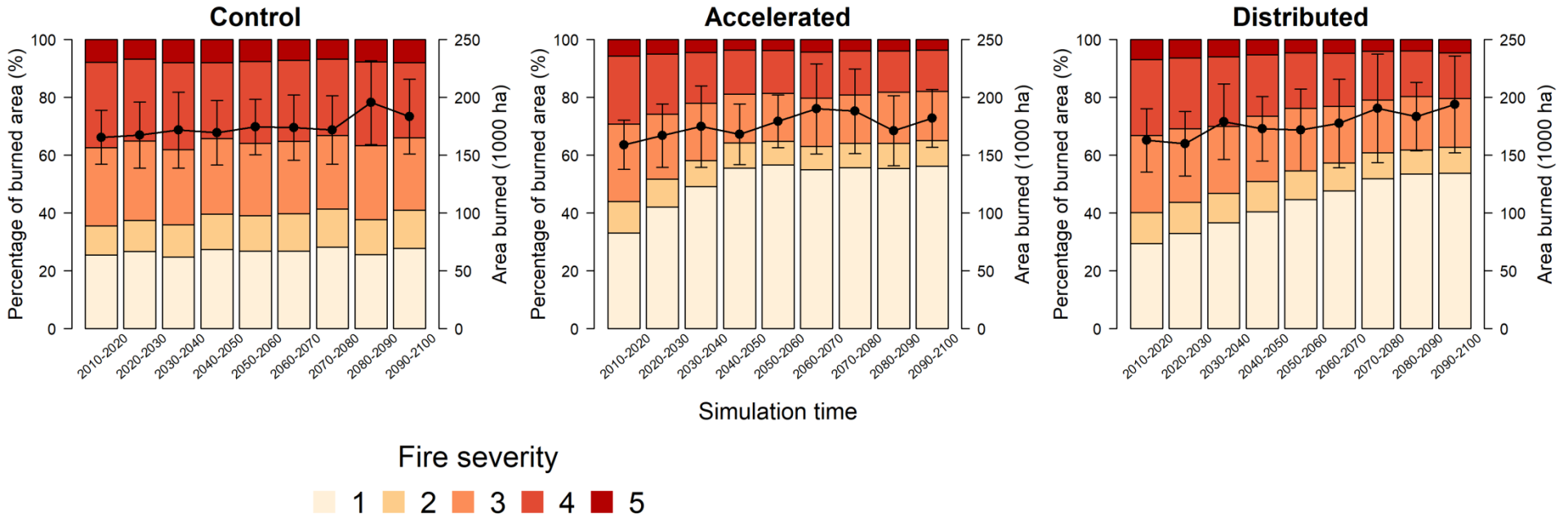
Treatments Across the Sierra

Scenarios	Accelerated	Distributed
Understory thin	25% per decade	12% per decade
Prescribed fire	10-30 year return interval	



Liang et al. (2018)

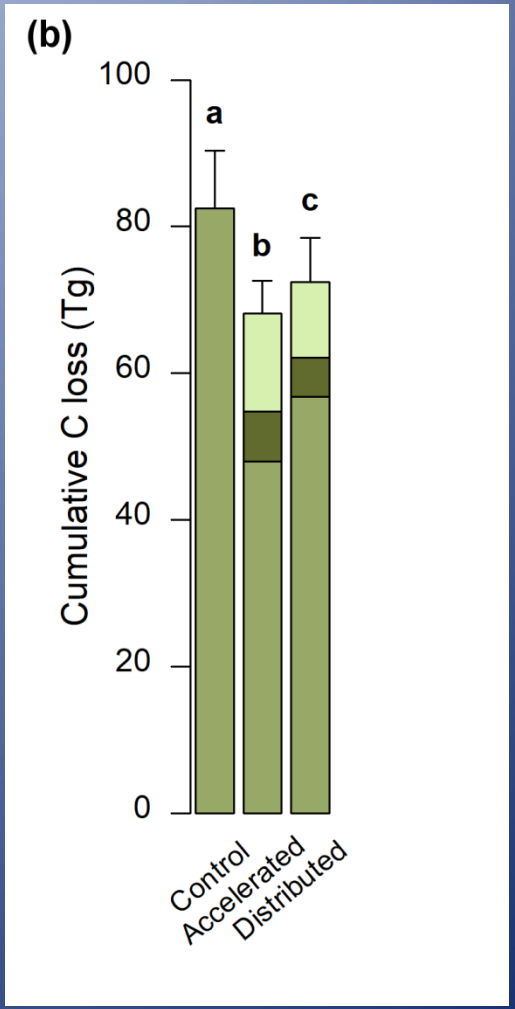
Treatments = Less Stand-Replacing Fire



Liang et al. (2018)

Treatment = Lower Cumulative Emissions

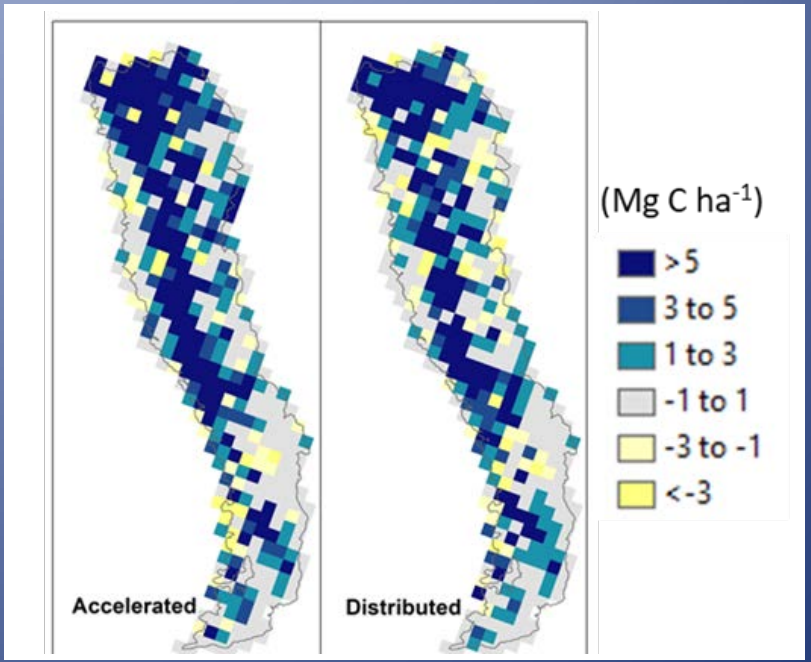
- Accelerated:
  - 42% lower wildfire emissions
- Distributed:
  - 31% lower wildfire emissions



Liang et al. (2018)

Accelerated treatment stores more C

- Accelerated:
  - 156 Mg C ha-1
- Distributed:
  - 154 Mg C ha-1
- 2100 Difference:
  - 6 million Mg C



Liang et al. (2018)

Management & C Stability

- Management has near term C costs
- In dry forests, treatments that reduce risk:
  - C is more stable
  - Emissions are lower
  - Long-term C storage is higher

Collaborators & Funding

- Dan Krofcheck
- Shuang Liang
- Louise Loudermilk
- Rob Scheller
- LeRoy Westerling