

Maximization vs. Stabilization: Evaluating Carbon Trade-offs in Fire- prone Forests

Matthew Hurteau

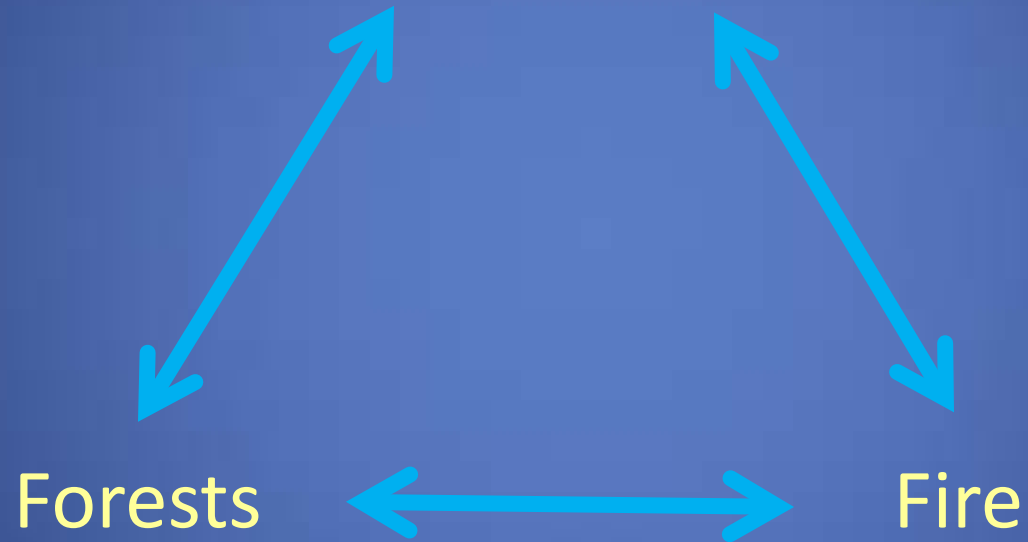


NORTHERN
ARIZONA
UNIVERSITY

Starting Assumptions

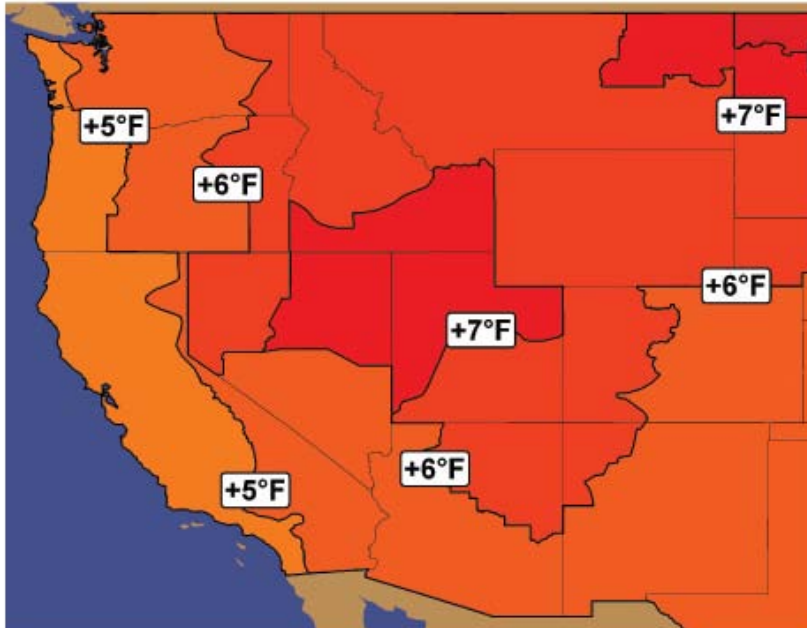


Climate System

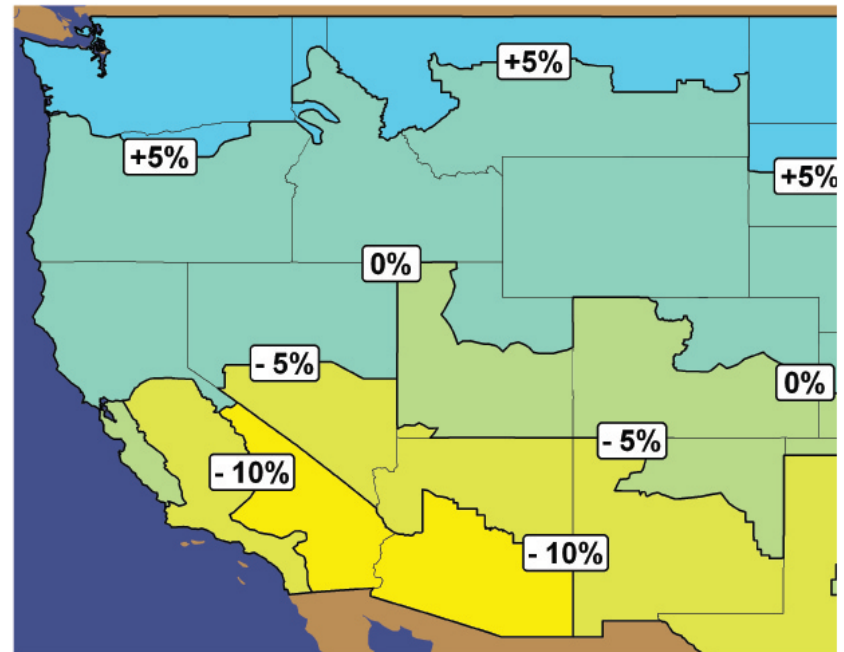


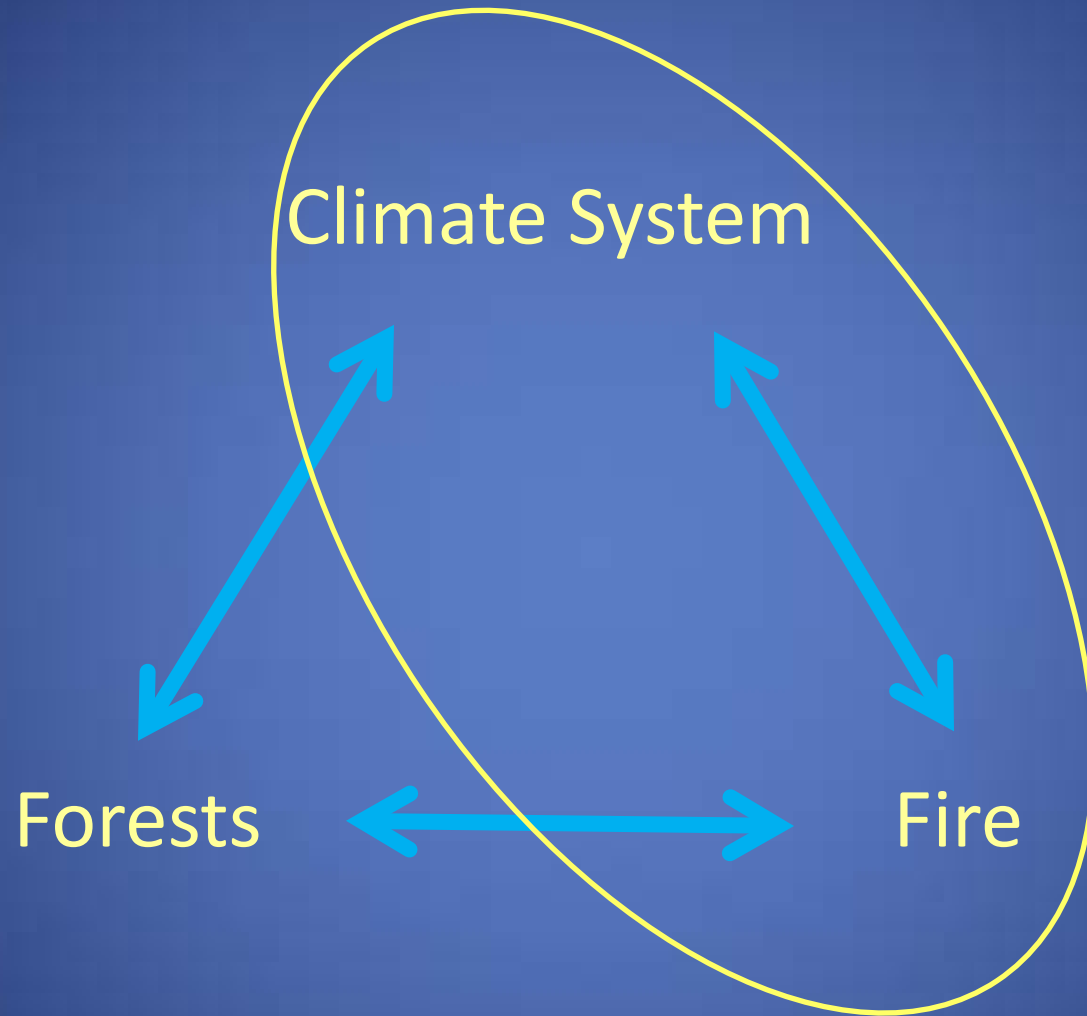
Western U.S. Projections

December–February Temperature Changes from 2091 to 2100



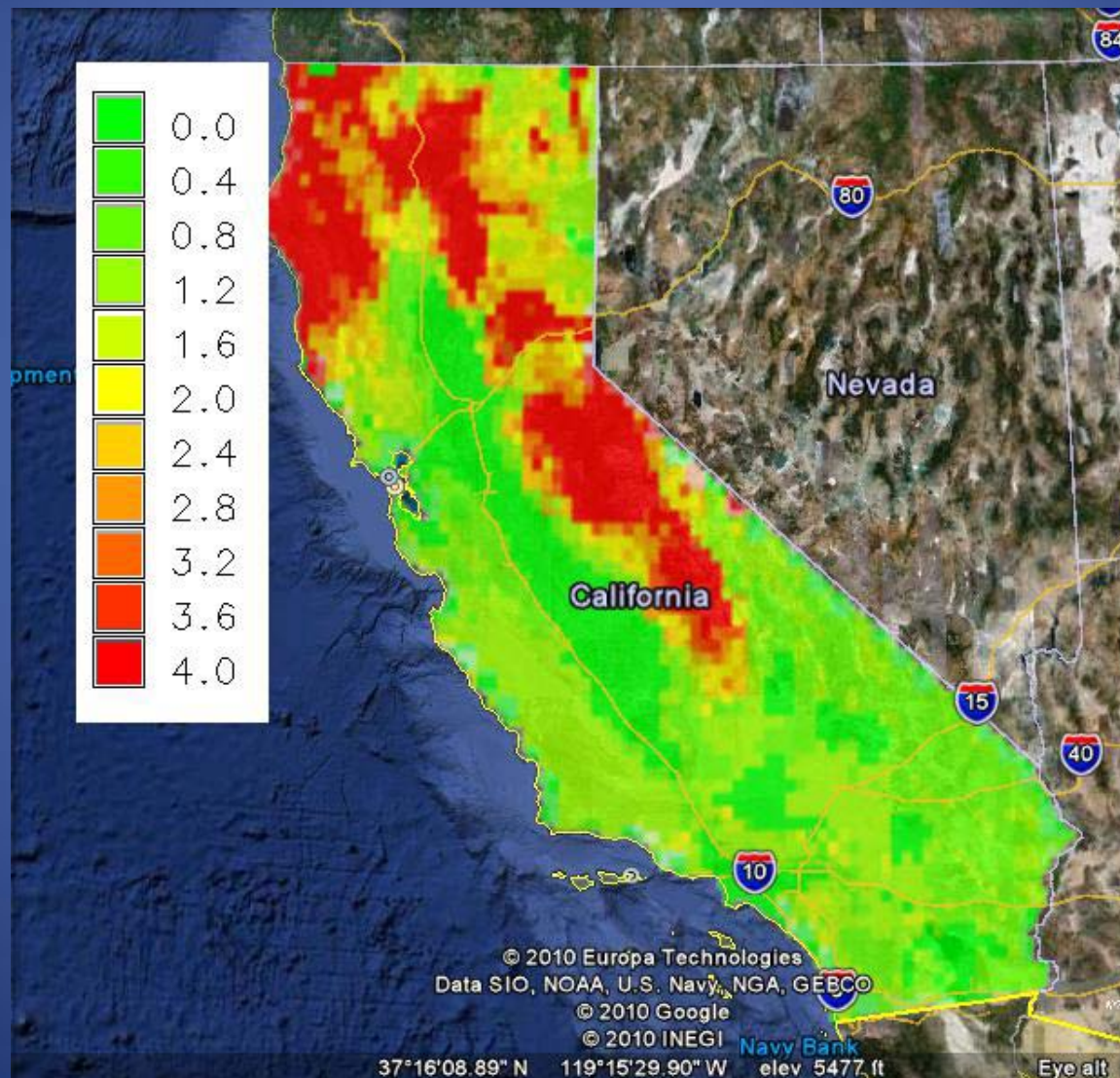
Changes in Annual Precipitation Averaged for 2091 to 2100



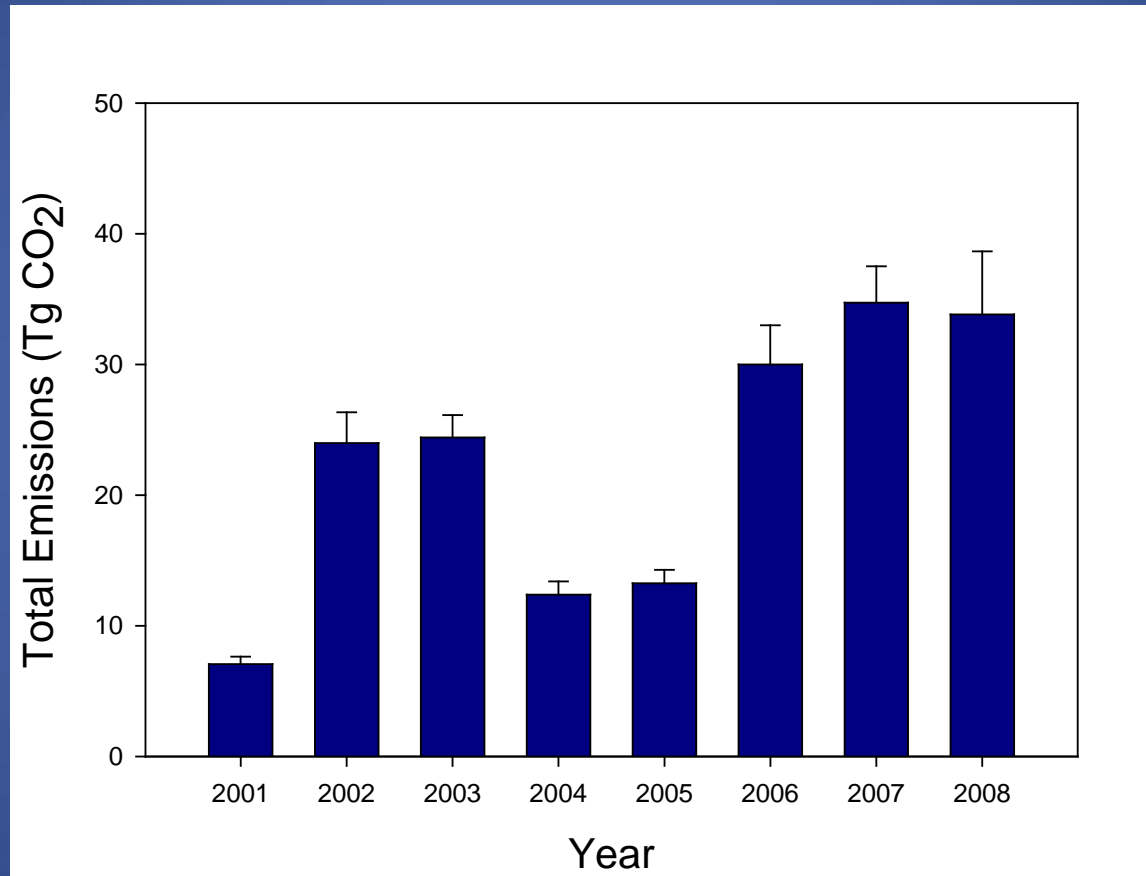


2085 Fire Projection

Red = 4 times more wildfire



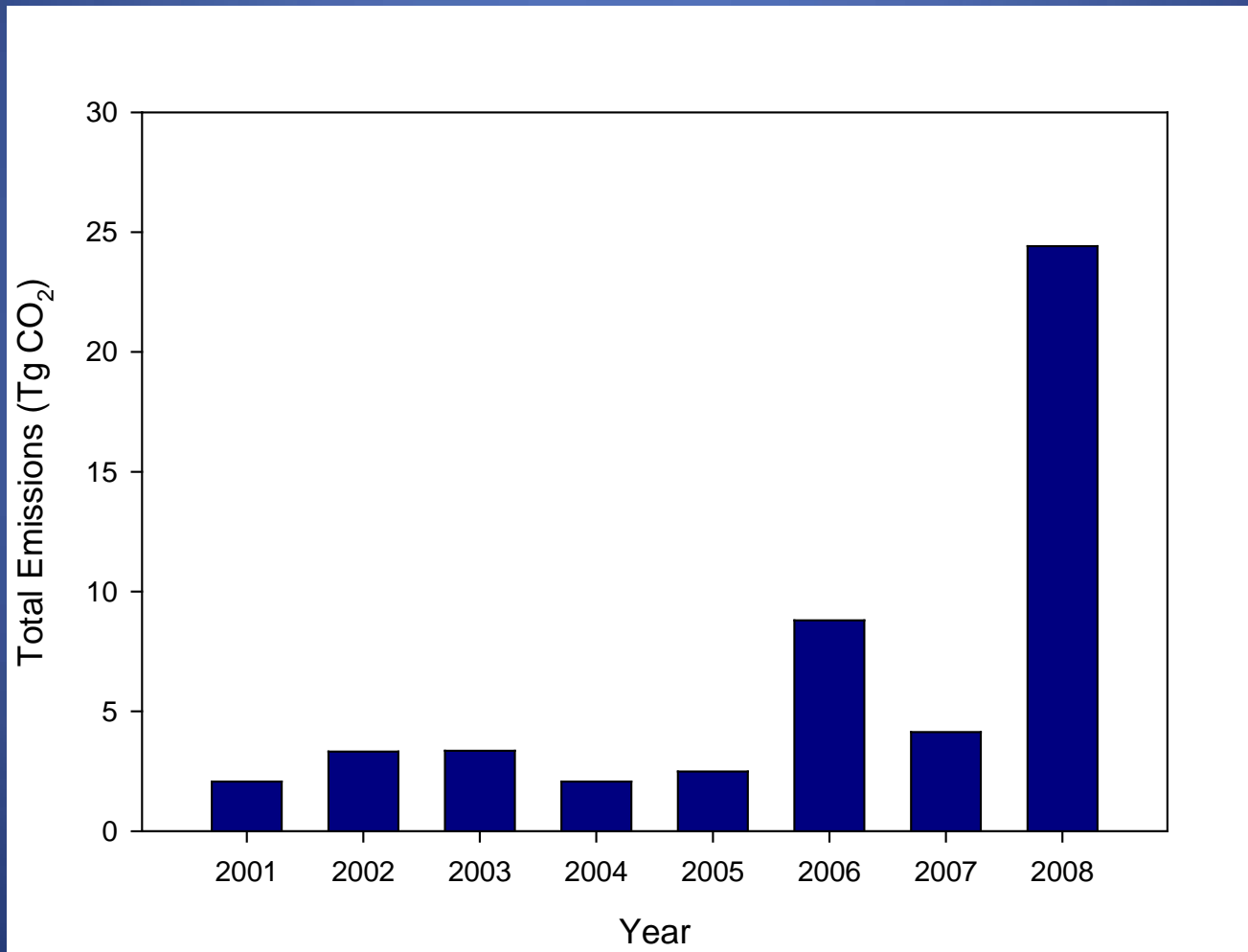
Wildfire Emissions

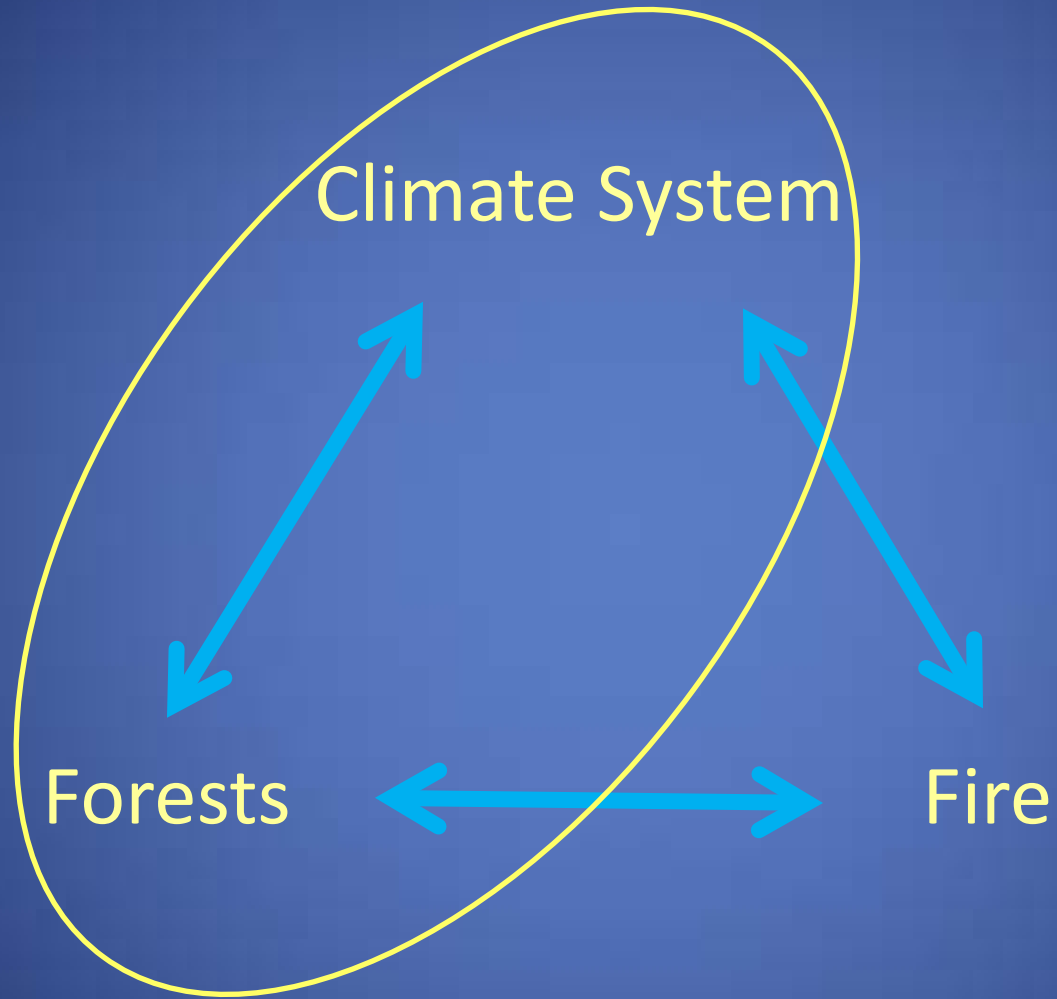


Wildfire emissions dry forest types

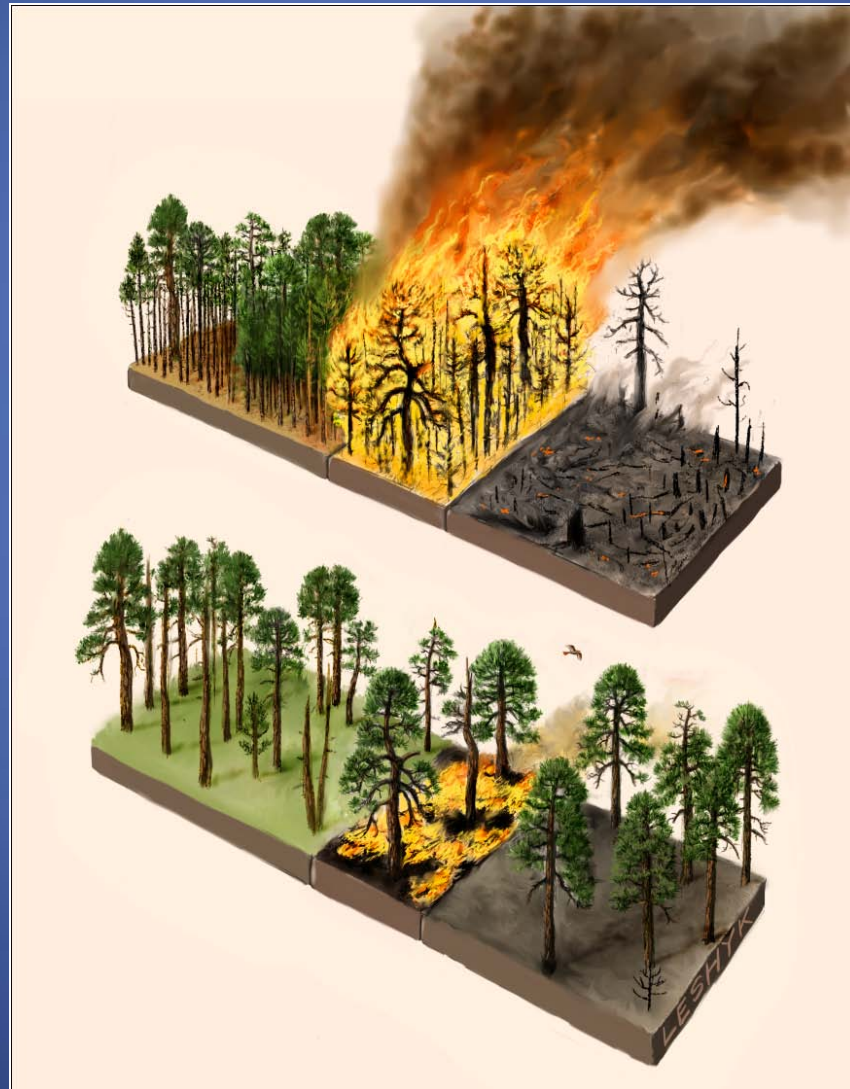
(Wiedinmyer and Hurteau 2010)

California





Cut Trees = Bad; Burn = Bad



What is a Manager to do?

Know the Trade-offs!

Where are we starting from?

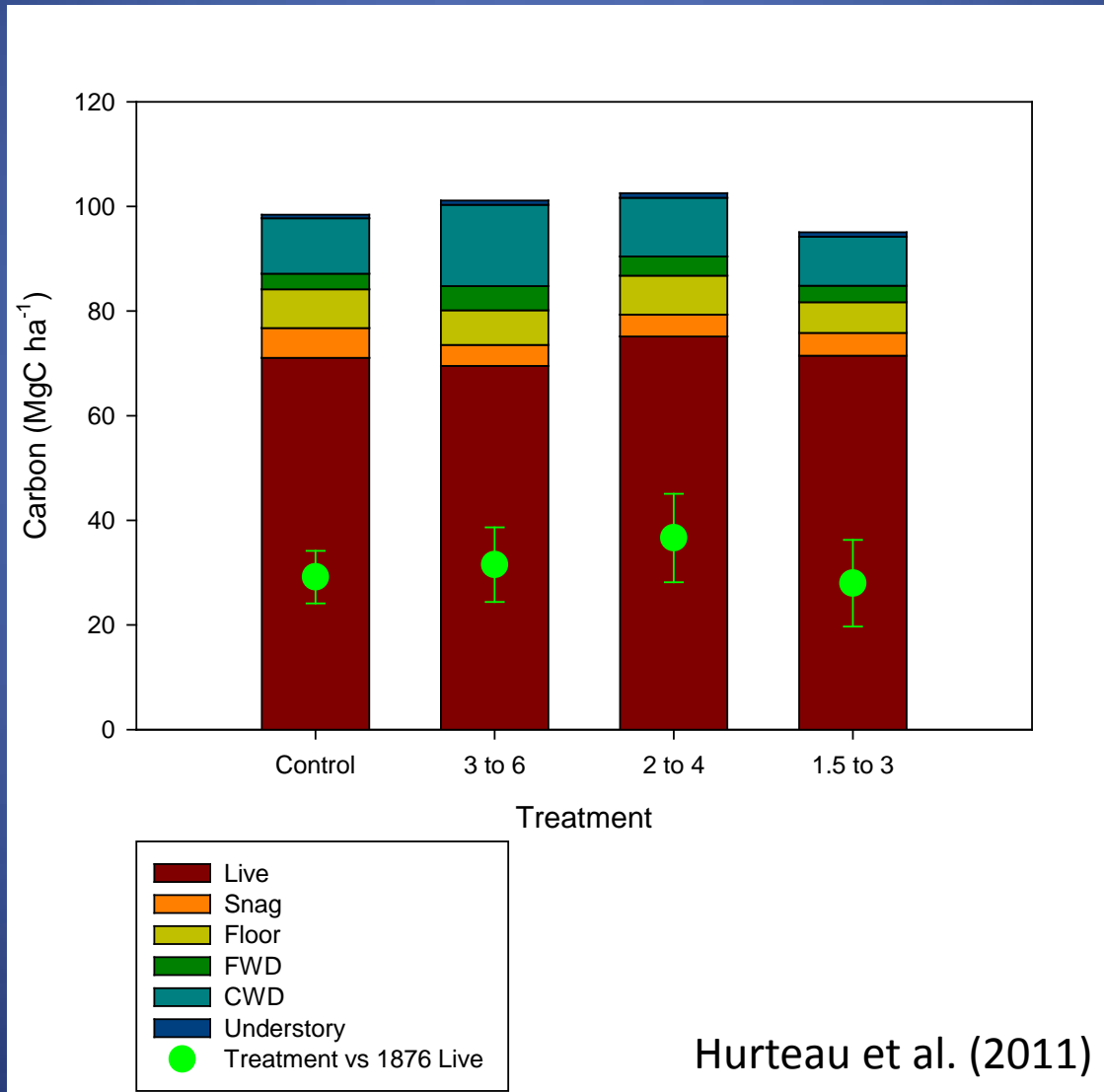
Arizona Ponderosa Pine



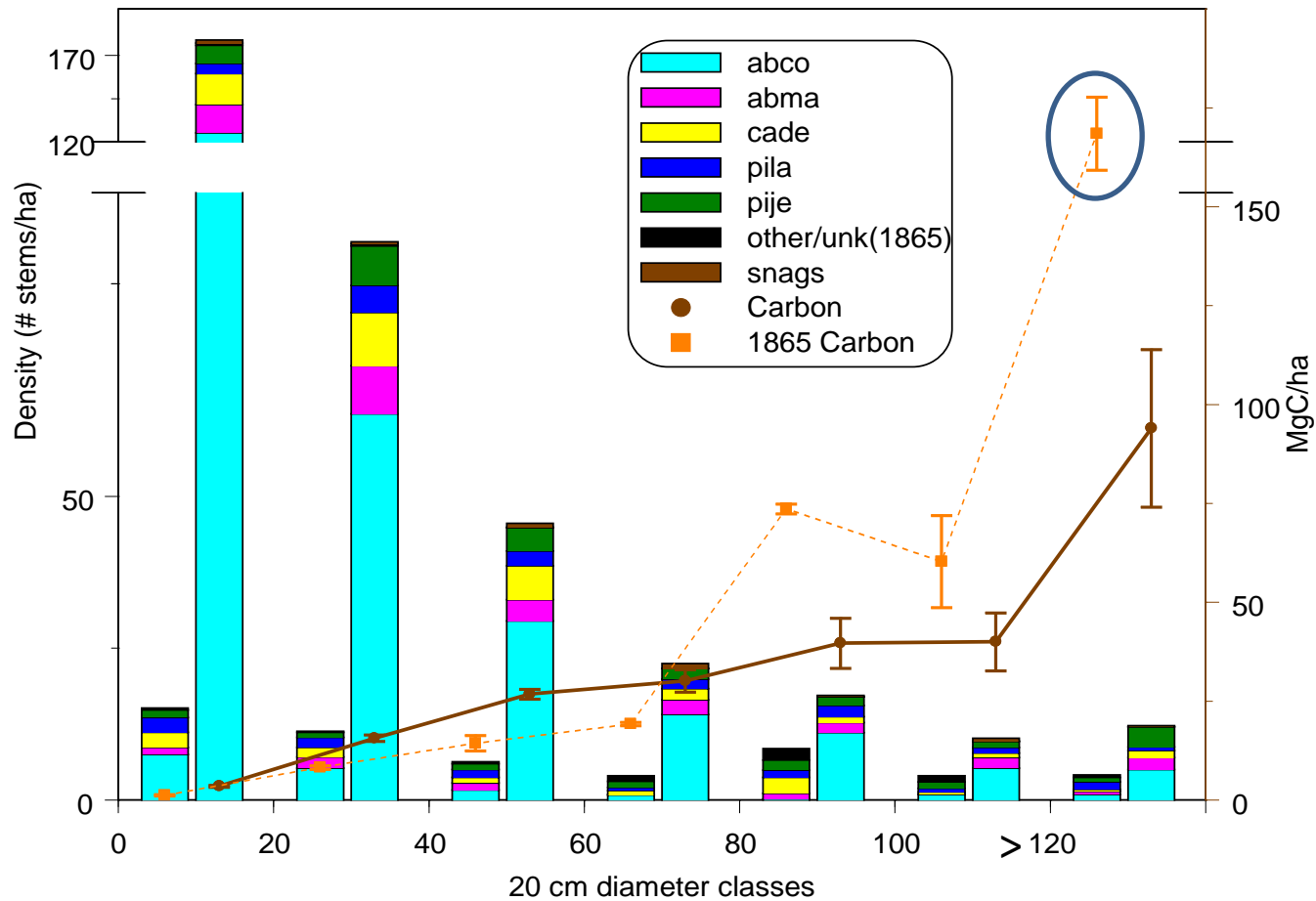
Sierran Mixed-Conifer



Arizona Ponderosa Pine



Sierran Mixed-Conifer



North et al. (2009)

The Carbon Conundrum

- System dependent!
- Sometimes there is a cost
- Sometimes there is a potential benefit

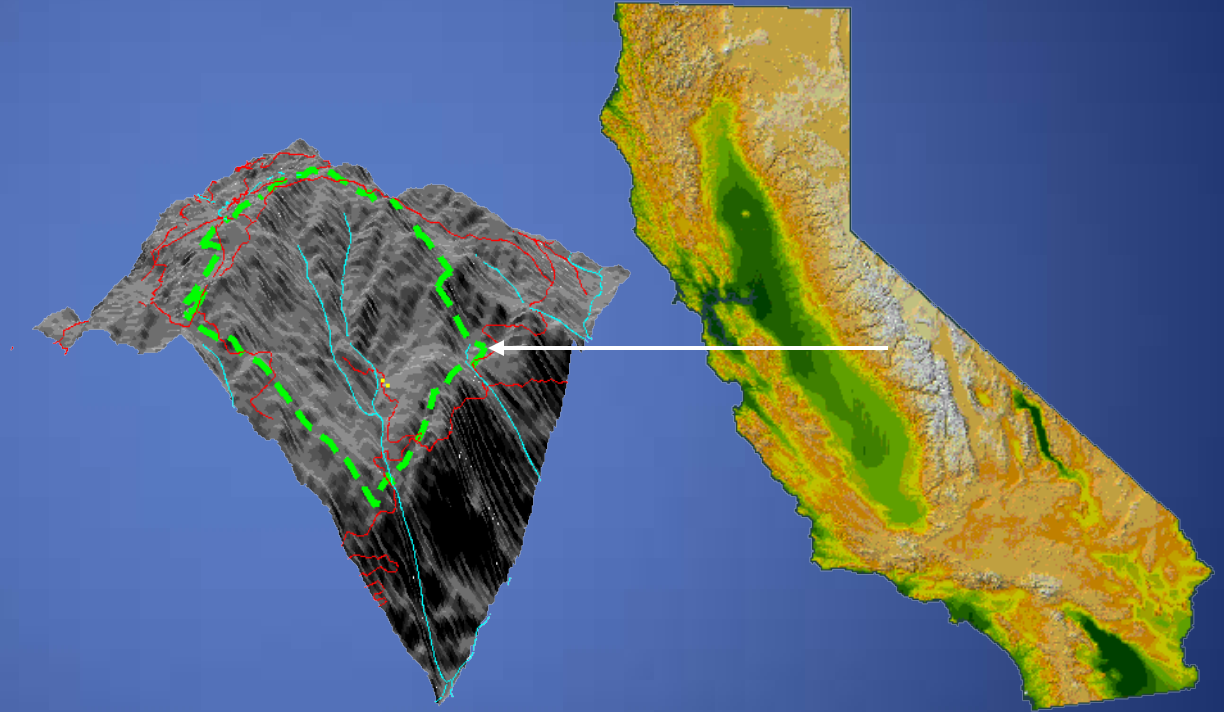
What are the actual C costs?

Does structure matter?

Avoided emissions benefit?

The Teakettle Experiment

- 3 levels of thinning
- Crossed with burning



Overstory Harvest



Burn Only



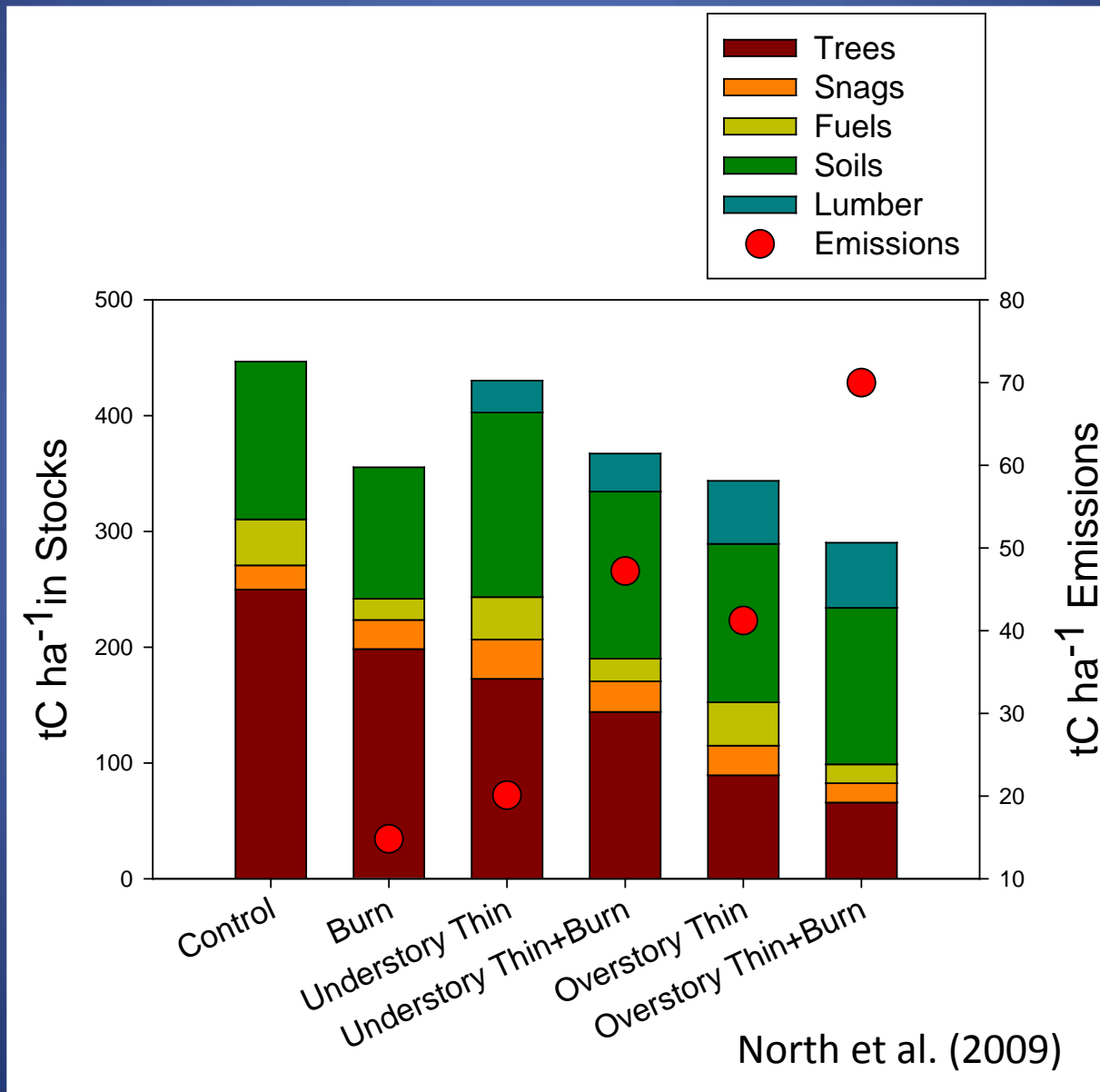
Understory Thin + Burn



The First Step:

Determining the carbon costs of
treatments

Fuels Treatments incur a C Penalty



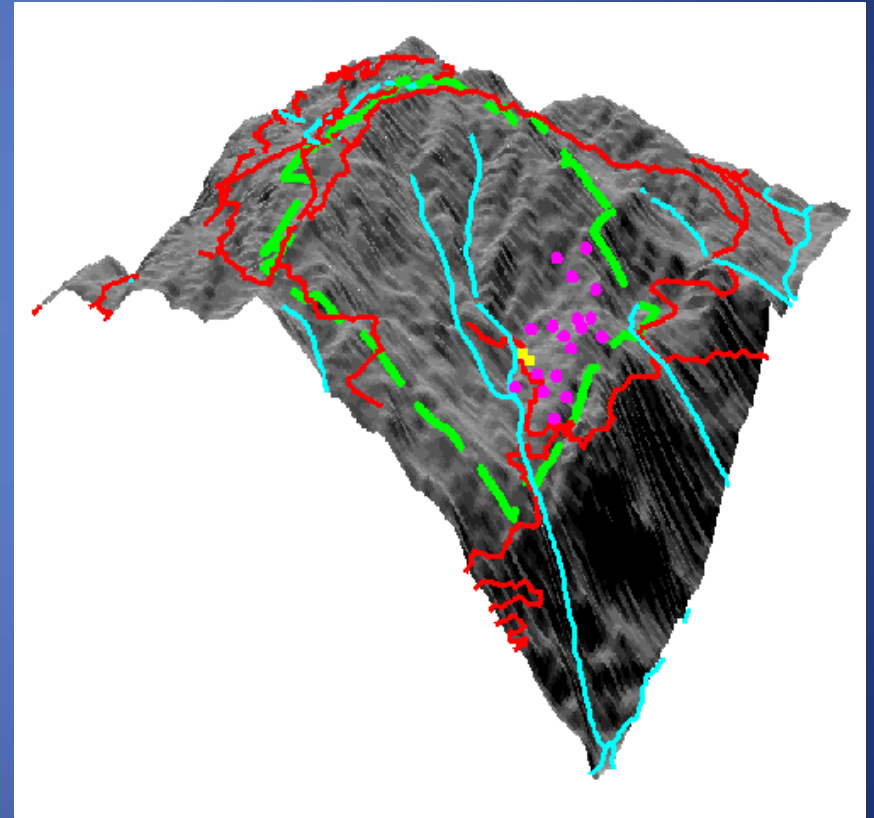
The Second Step

Model growth over time with fire to determine:

- If structure matters?
- Avoided emissions benefit?

Forests, Wildfire, & Carbon

- Fire suppressed forest structure
- Modeled structural treatments
- Modeled 97th percentile fire weather



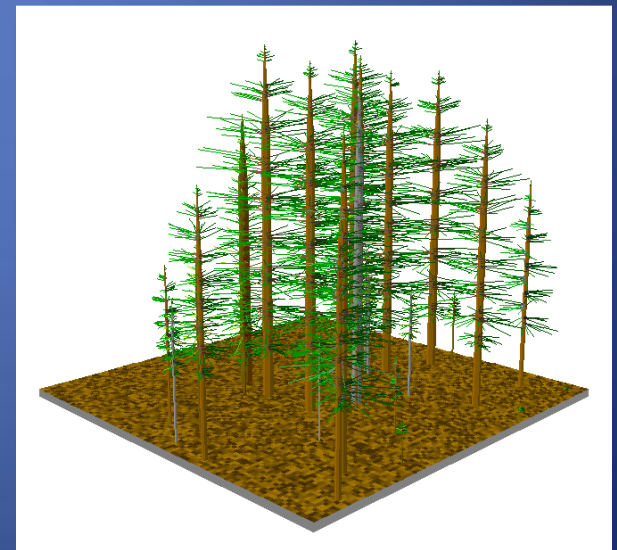
Treatments

- 1865 Forest Structure
- Restoration thin
- Thin from below
- No thin

All treatments crossed with
prescribed fire

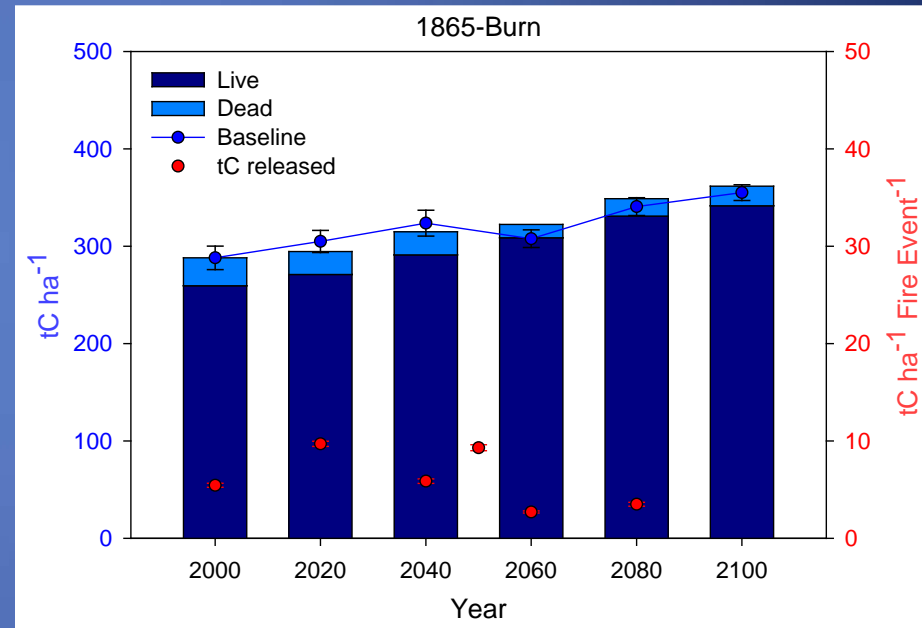
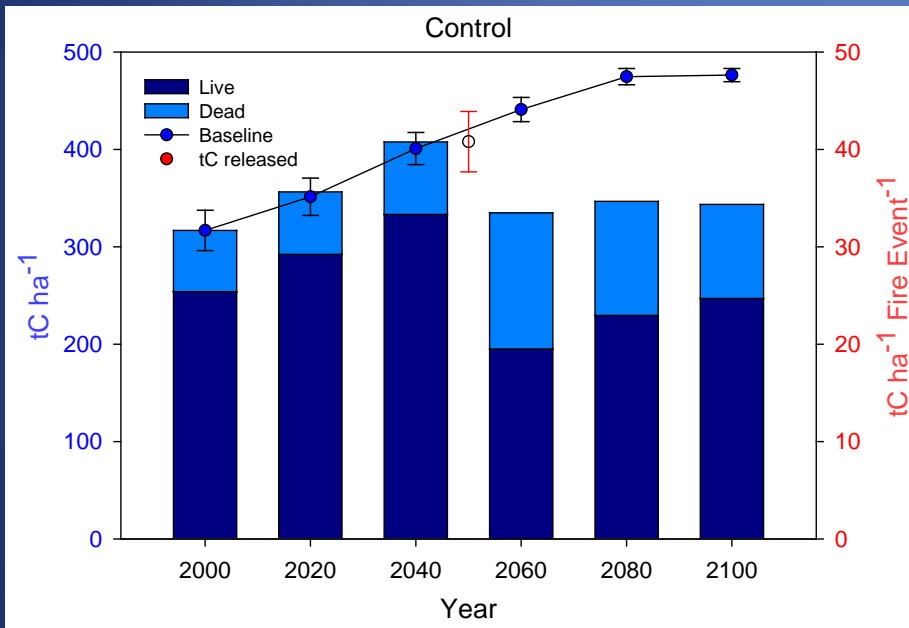


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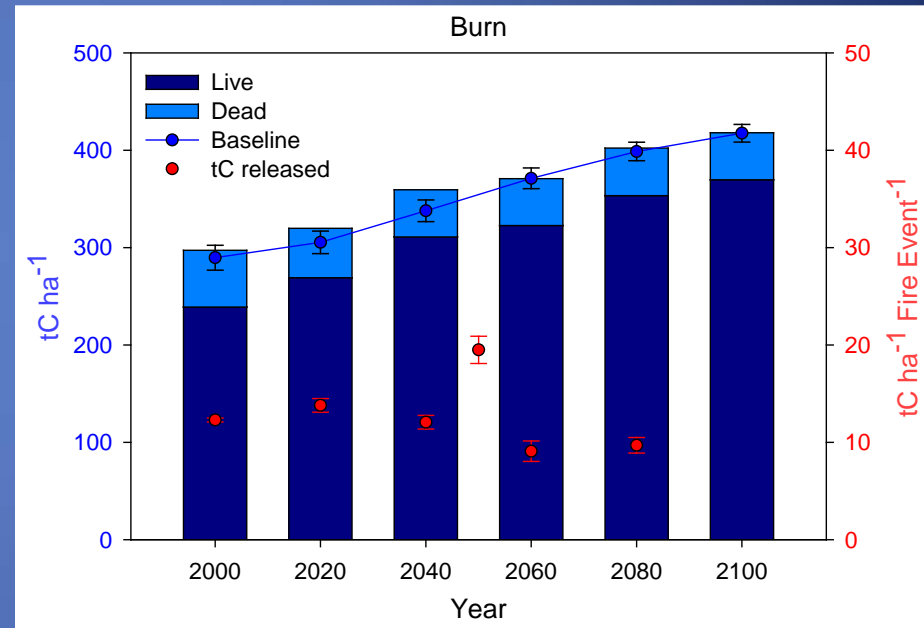
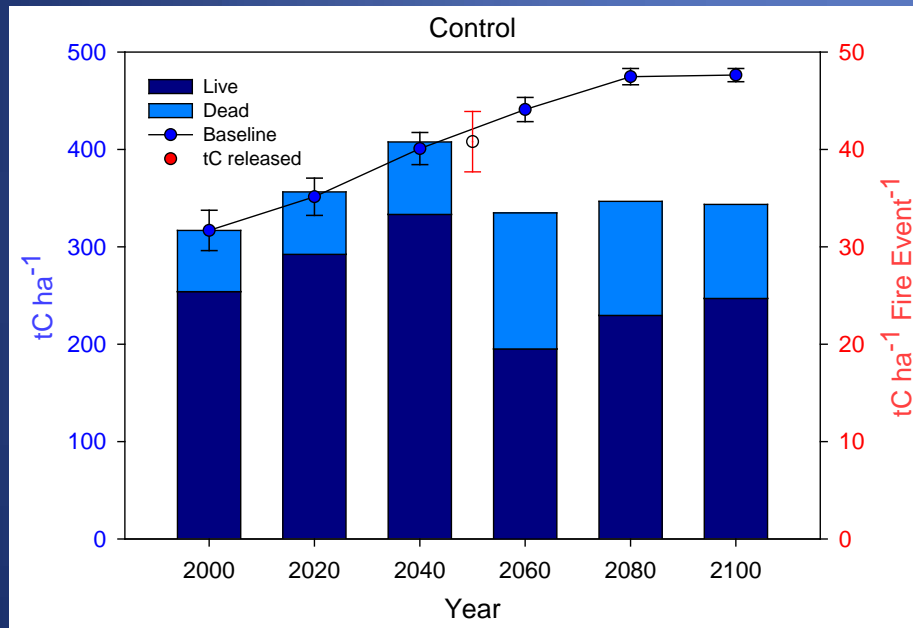


1865

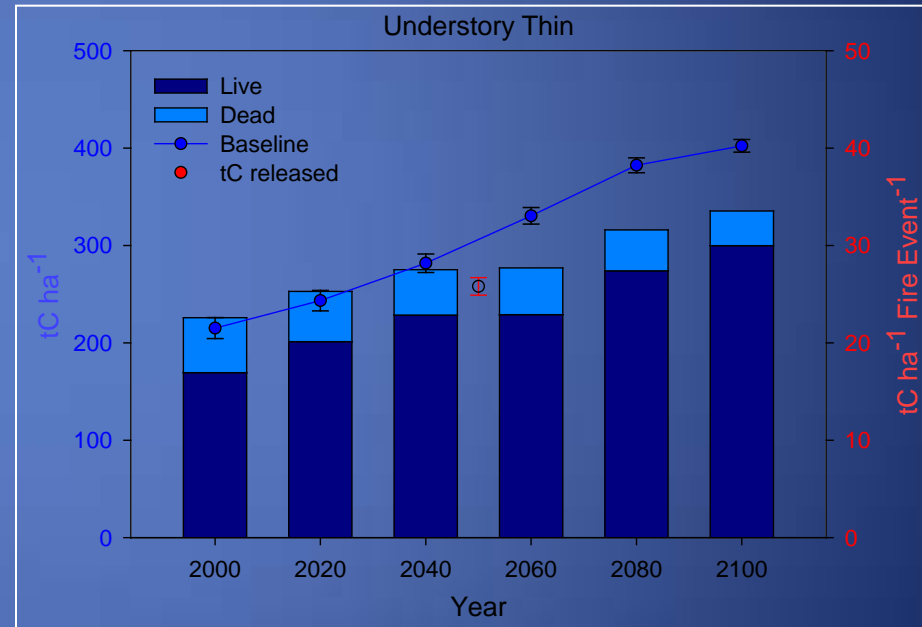
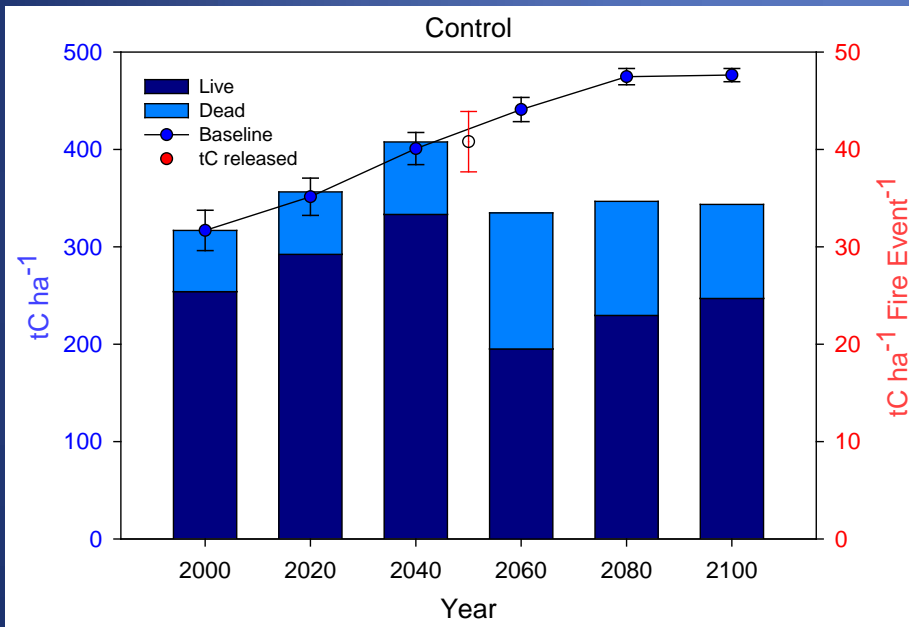
Current vs. Historic



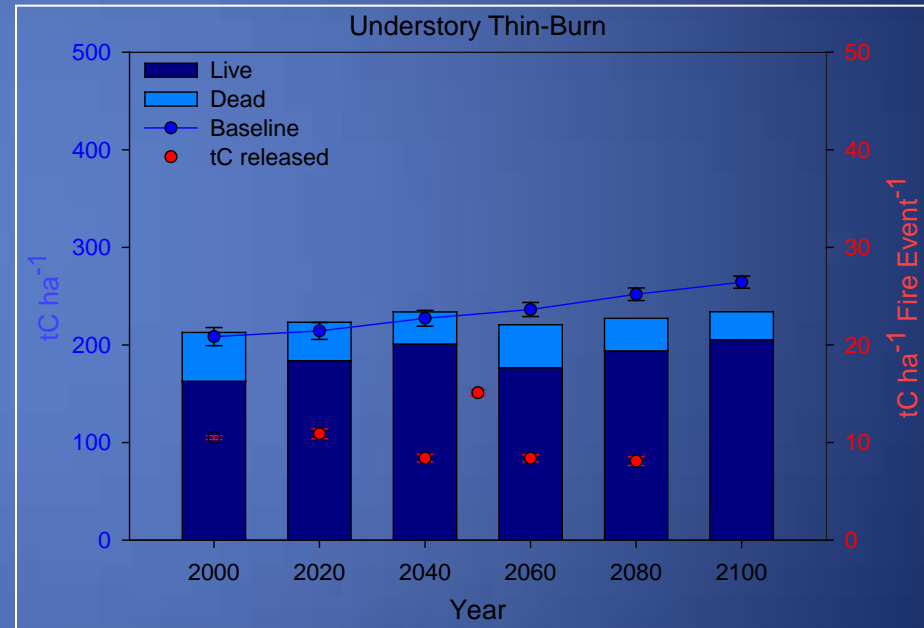
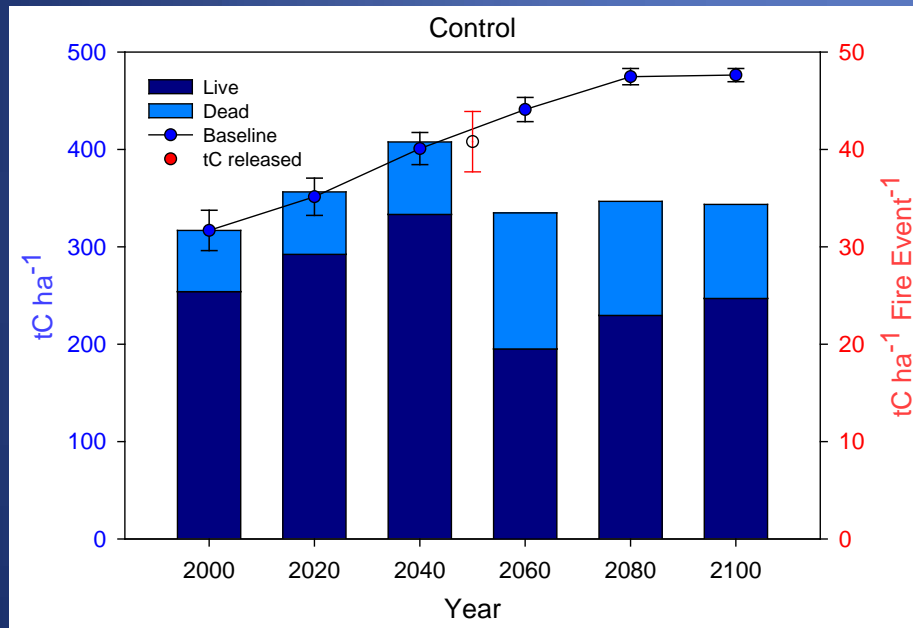
Control vs. Burn Only



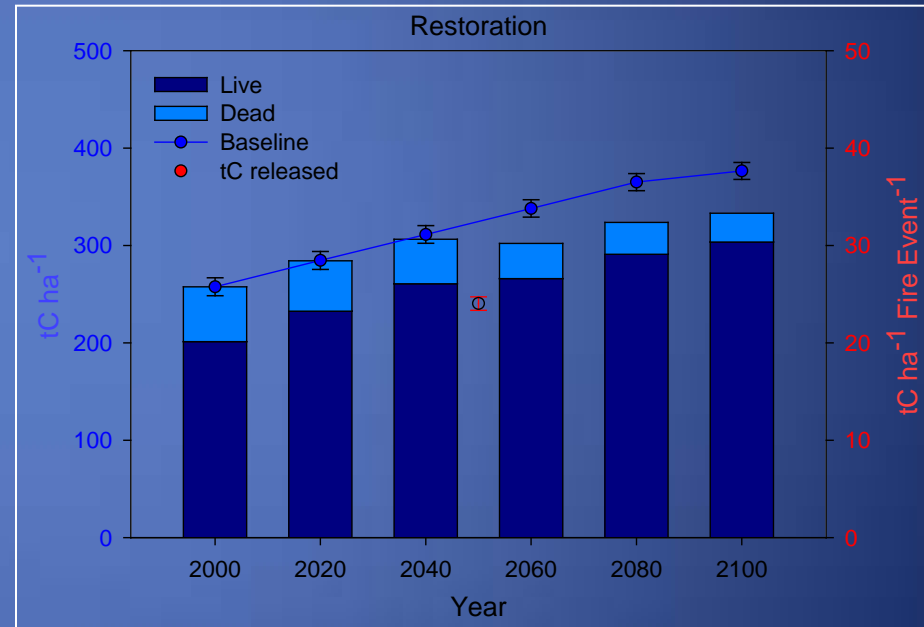
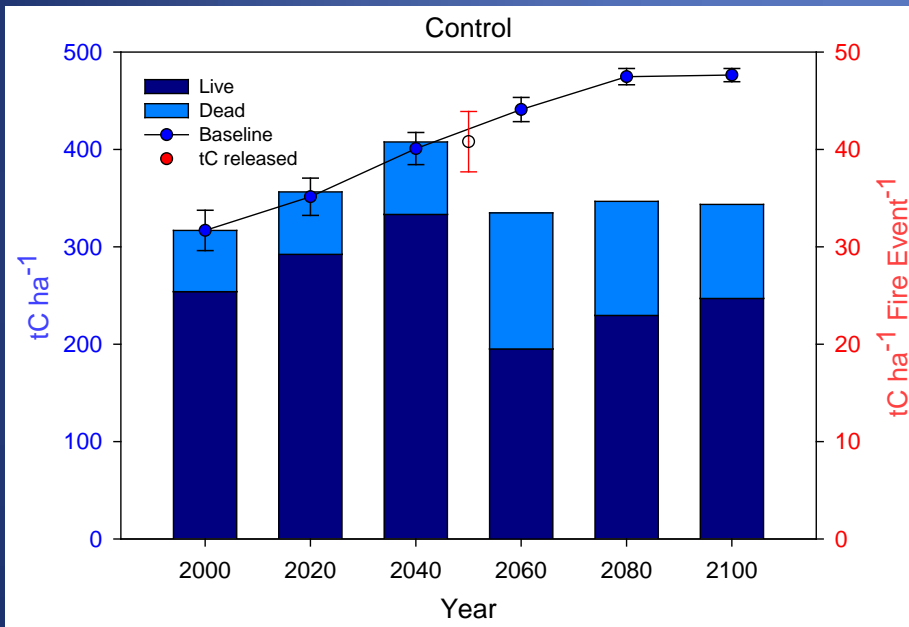
Control vs. Understory Thin



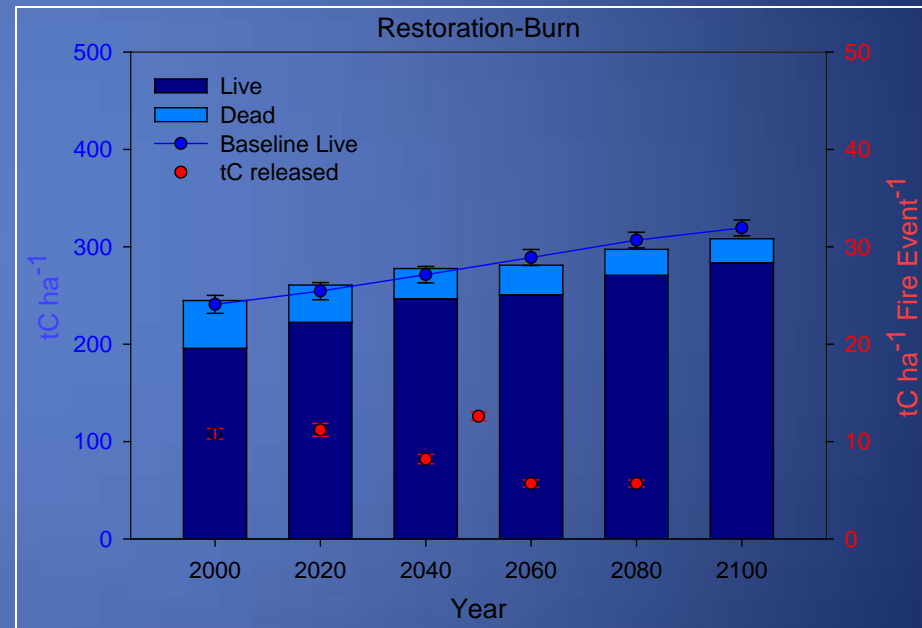
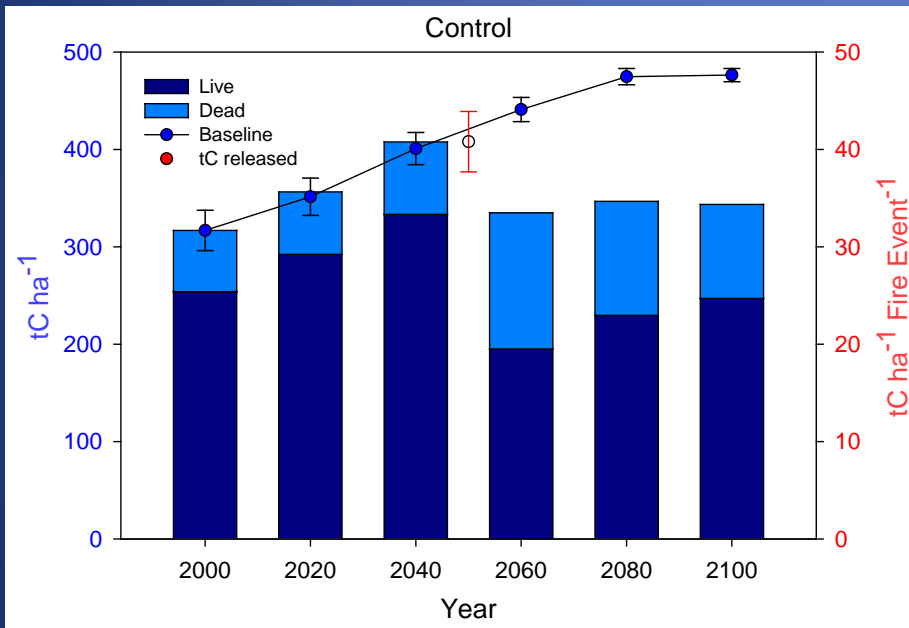
Control vs. Understory Thin+Burn



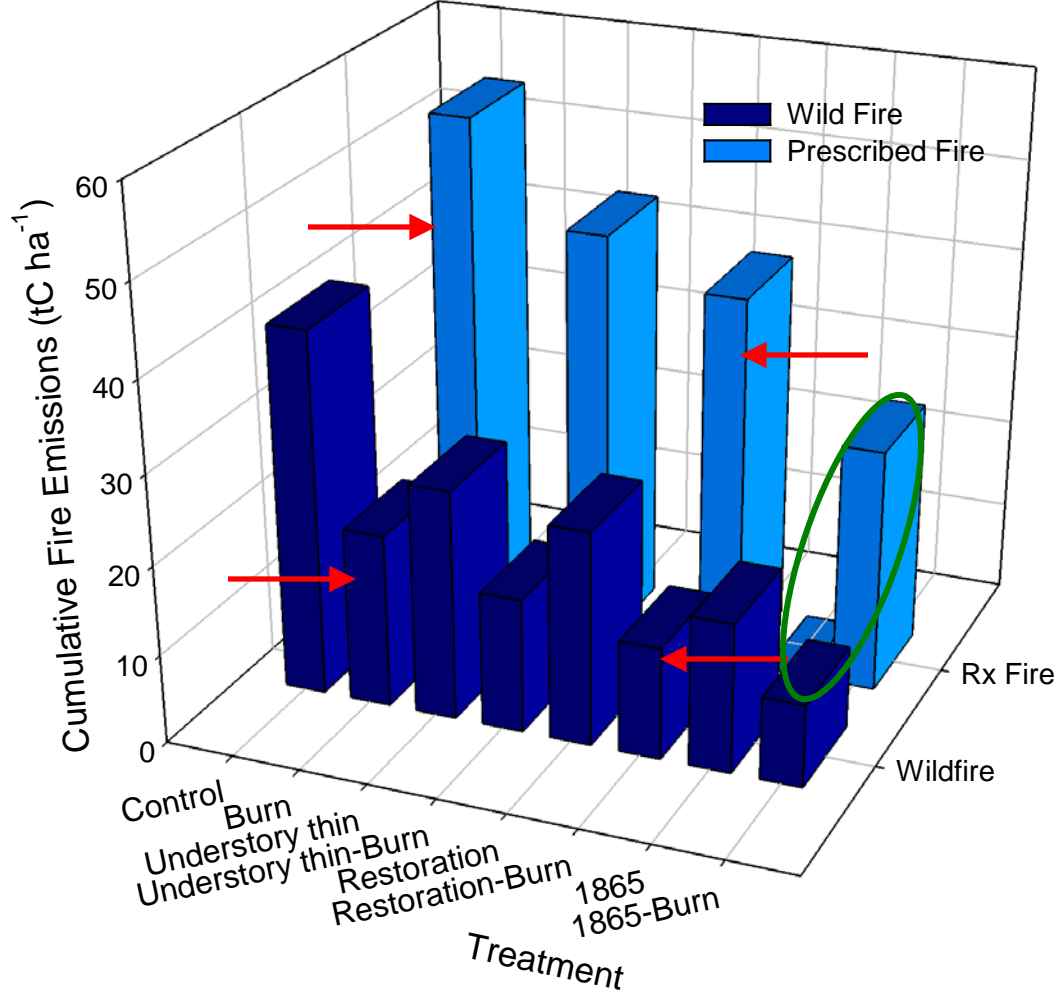
Control vs. Restoration



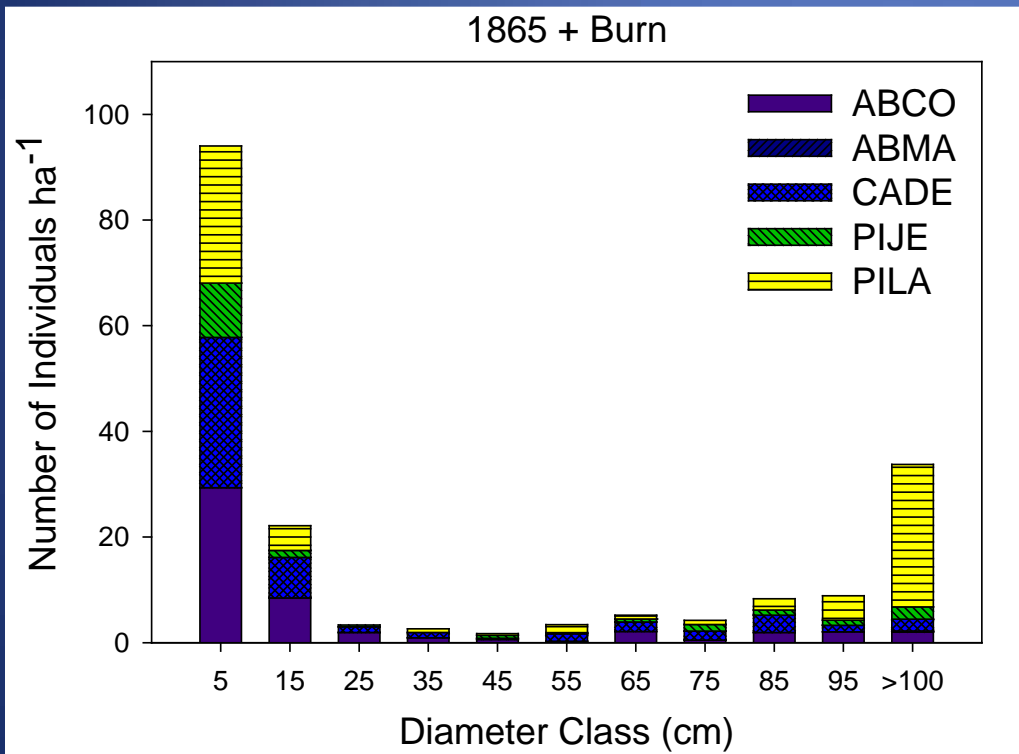
Control vs. Restoration+Burn



Restoration = Lower Emissions

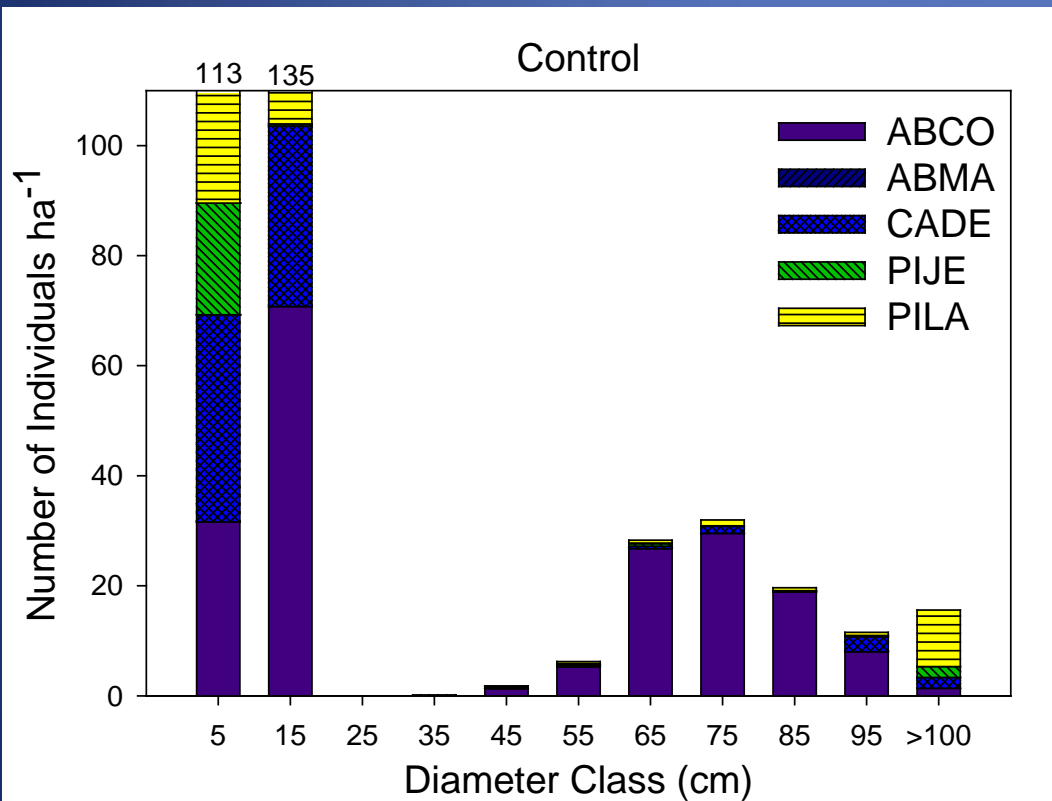


Historic Forest Structure



- Low density
- Large individuals
- Fire tolerant species
- Diverse understory

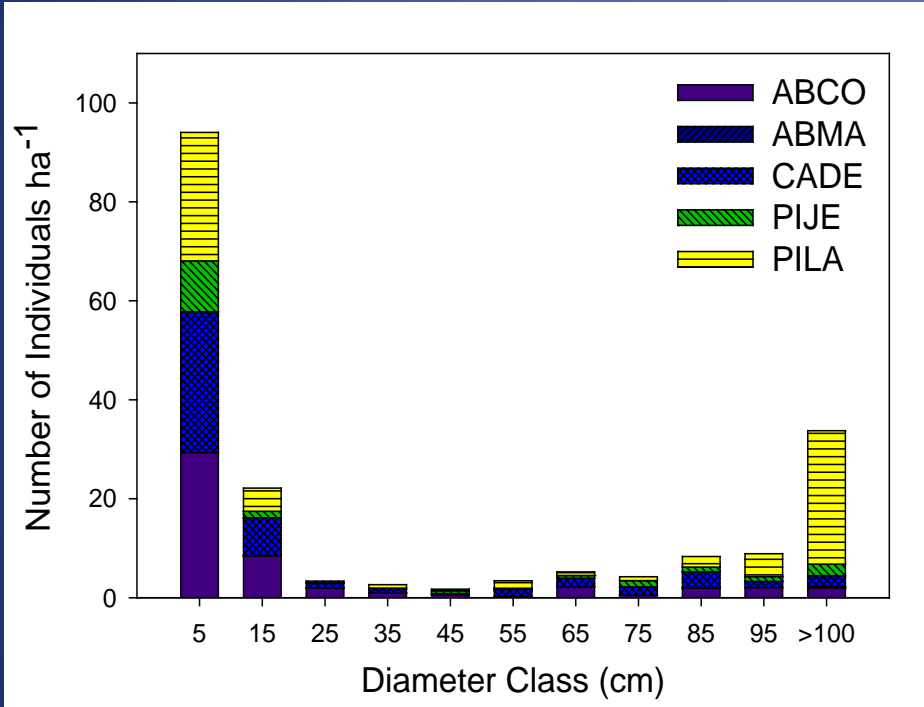
Current Forest Structure



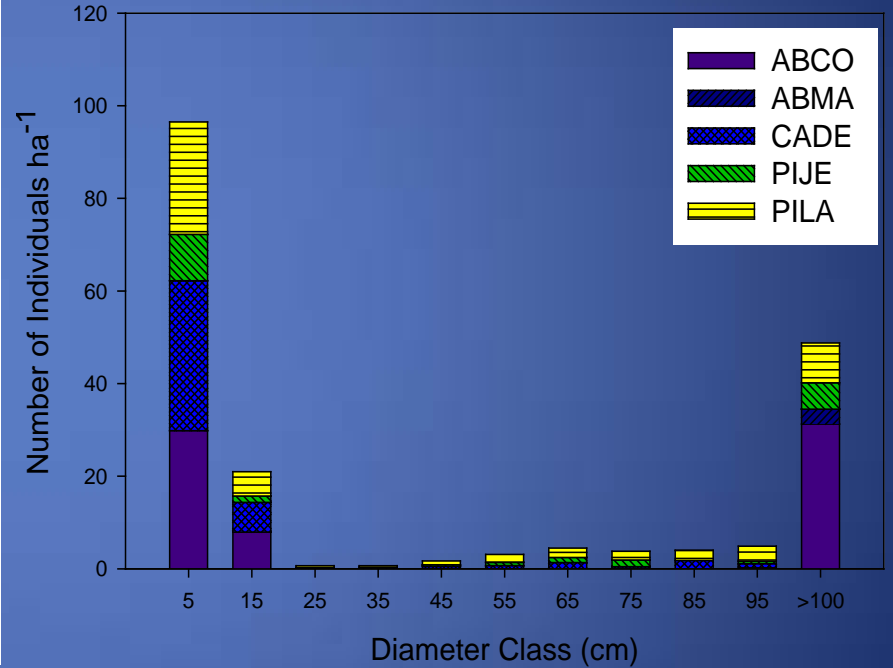
- High density
- Smaller individuals
- Fire intolerant species
- Lower understory diversity

Forest Structure

1865+Burn

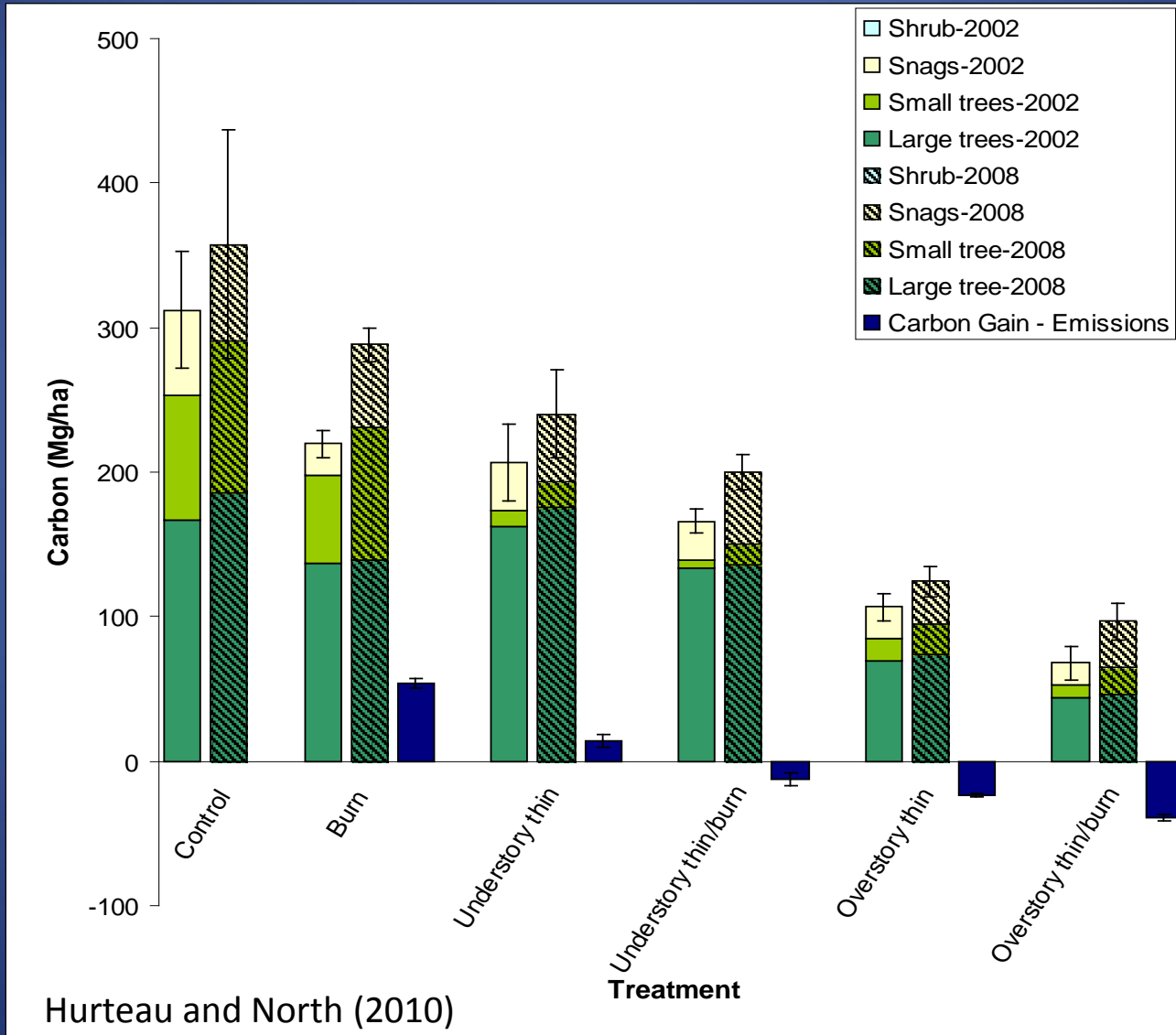


Restoration+Burn



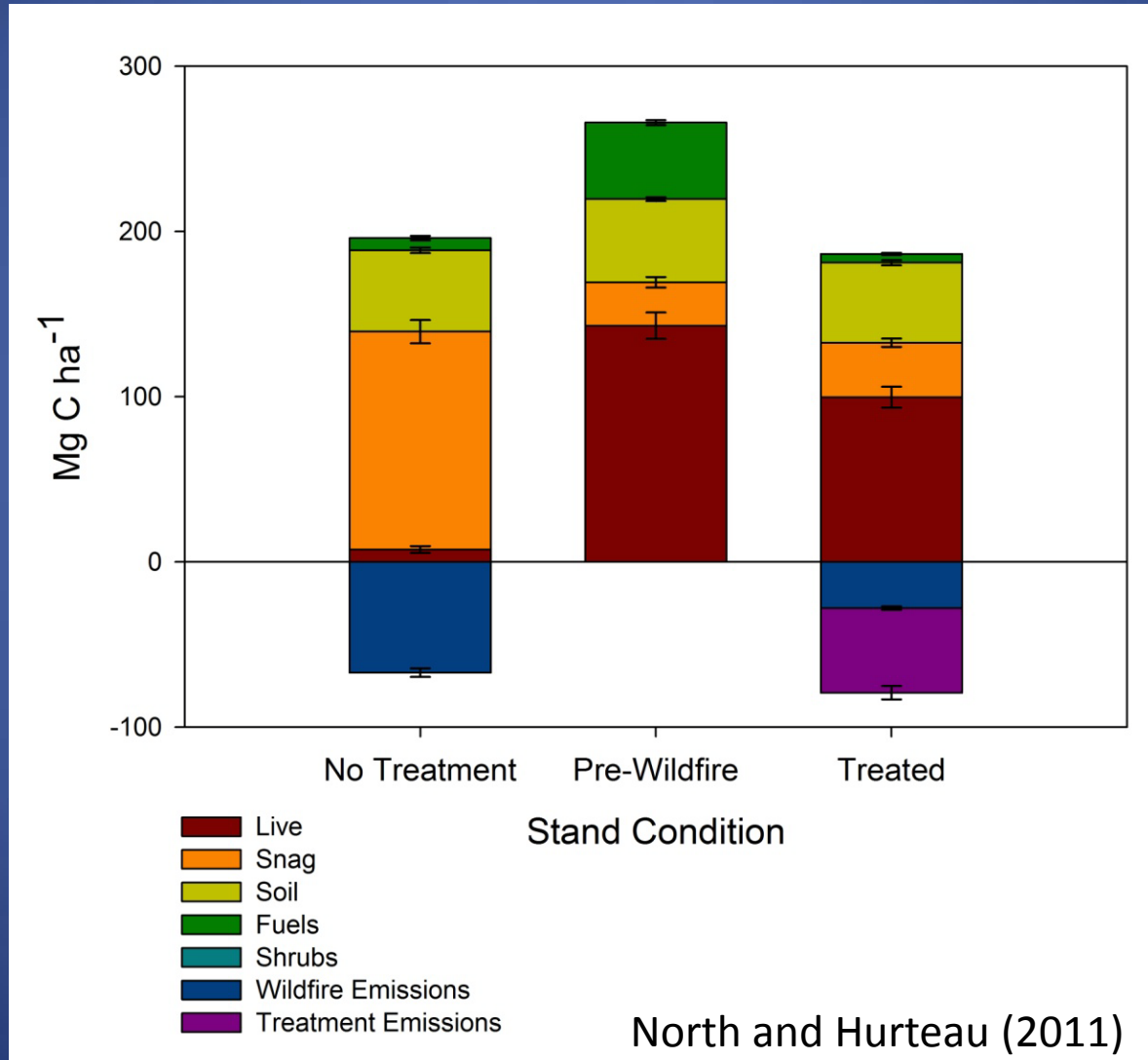
Models are useful, but what does
reality look like?

7 Years Post-Treatment



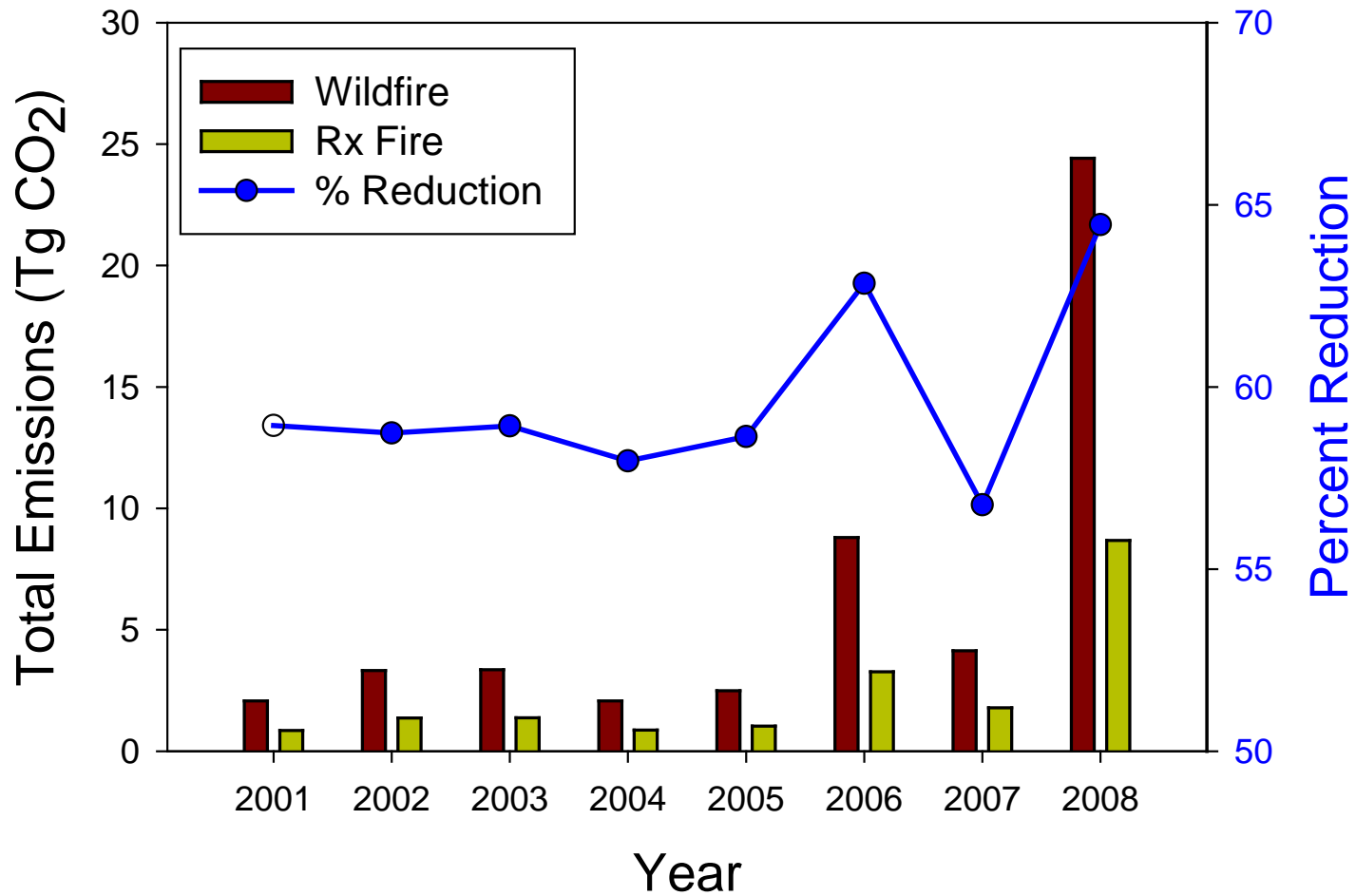
Does this concept scale up?

Results on the Landscape

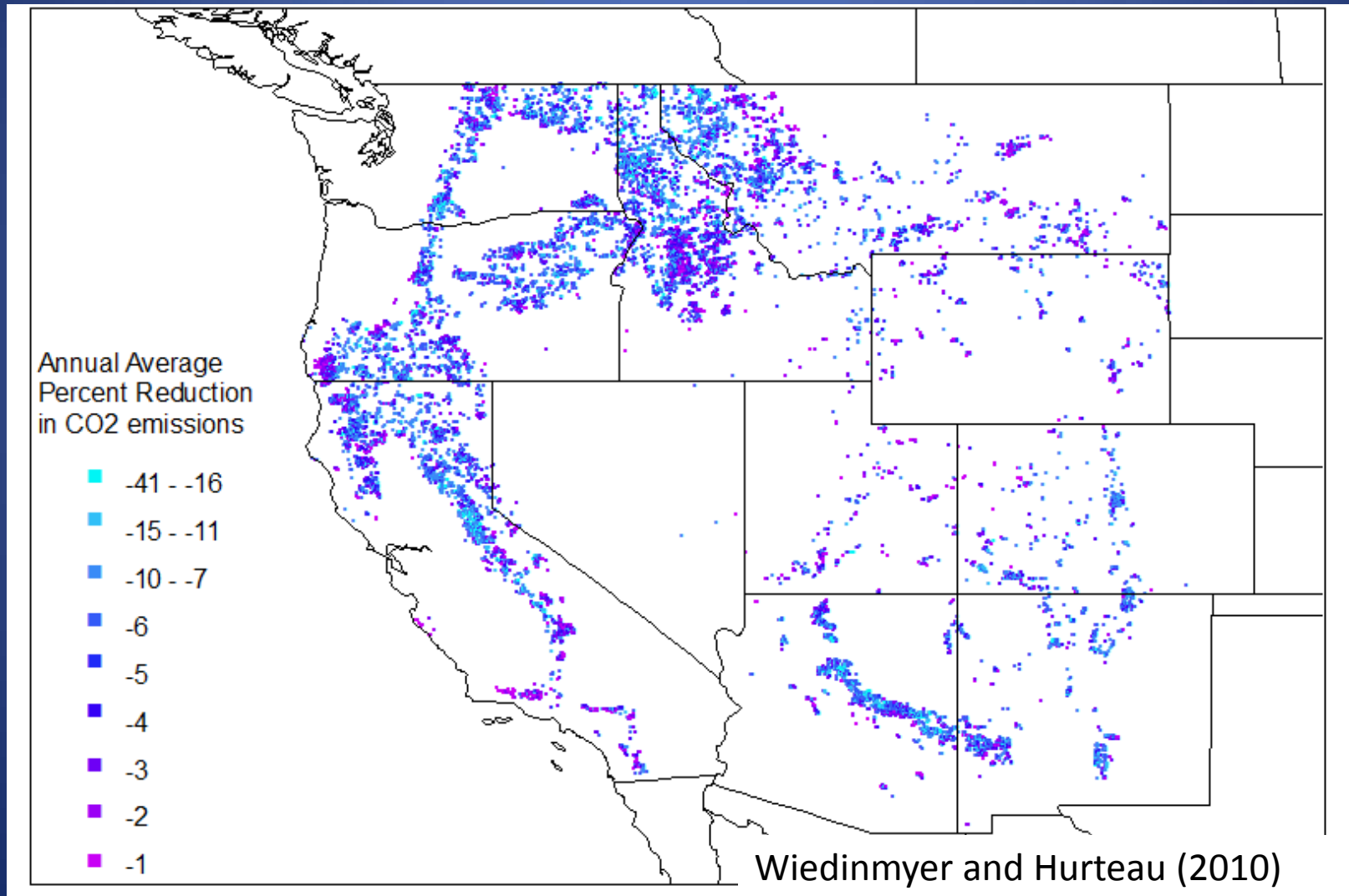


North and Hurteau (2011)

State-Level Results



Results in the Region



Maximization vs. Stabilization

- Upfront carbon costs
- Costs recovered rather quickly
- Avoided emissions benefit
- More live trees post-wildfire

Collaborators and Support

- Bruce Hungate
- George Koch
- Malcolm North
- Christine Wiedinmyer
- Jim Innes
- Western Regional Center of the National Institute for Climatic Change Research
- USDA Forest Service