Forest Fuel Treatments in a Changing Climate: Assessing Forest Productivity & Carbon Storage Potential

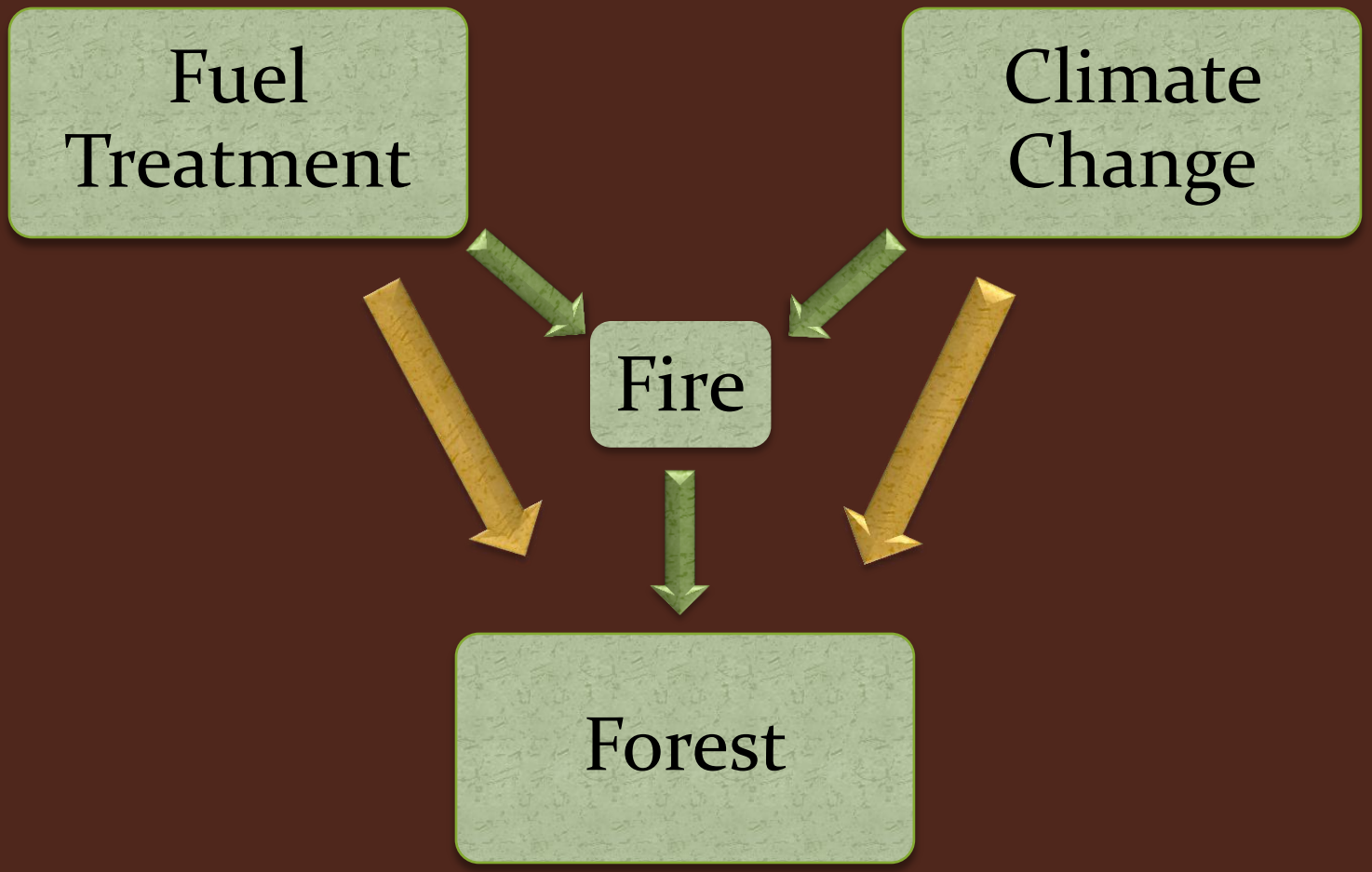
SNPLMA (P049)

Louise Loudermilk

Research Faculty, PSU

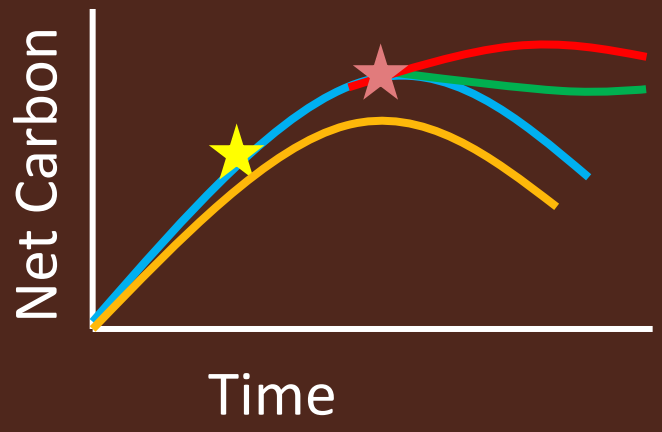
Robert Scheller, PSU
Peter Weisberg, UNR
Jian Yang, UNR
Alison Stanton
Carl Skinner, US-FS

Project Overview



Forest Carbon at Lake Tahoe

- Does the LTB have C storage potential?
  - Shifts from changing climate? or changing fire regimes?



- How is C distributed between the live, dead, and belowground pools?

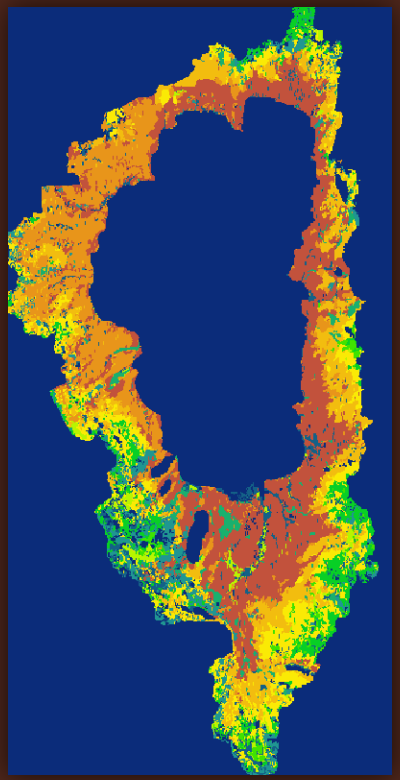
Forest C, Climate, & Fuels Management

- Do fuel treatments increase C sequestration potential?
- If so, can we mitigate the effects ~ climate change?
- Strategic placement vs. area treated vs. rotation period

Study Focus

Project the long-term effects of:

- Climate change
- Wildfire
  - Altered Ignition Patterns
- Fuel treatments



on Forest Succession and Carbon Dynamics (gain or loss) in the entire LTB

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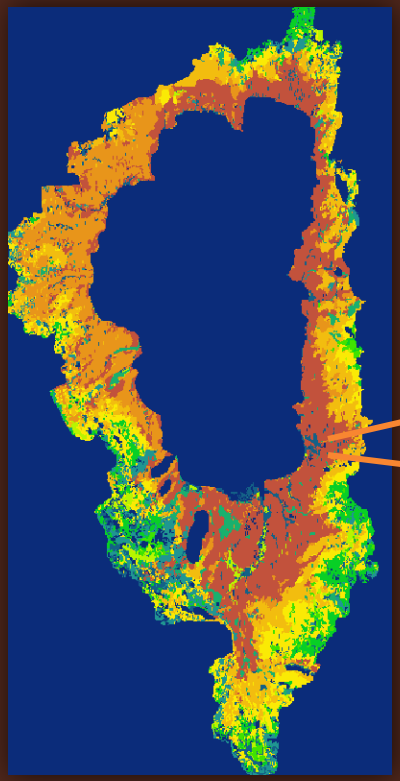
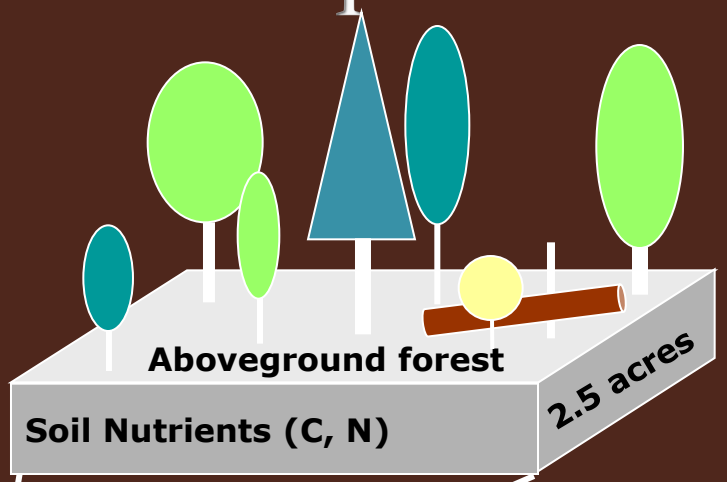
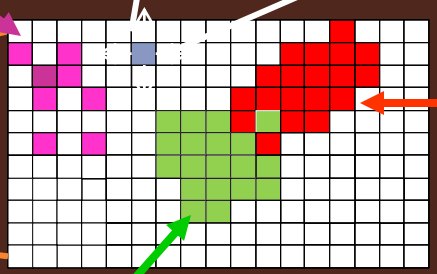
Spatially Interactive Landscape

Climate Change





Seed Dispersal

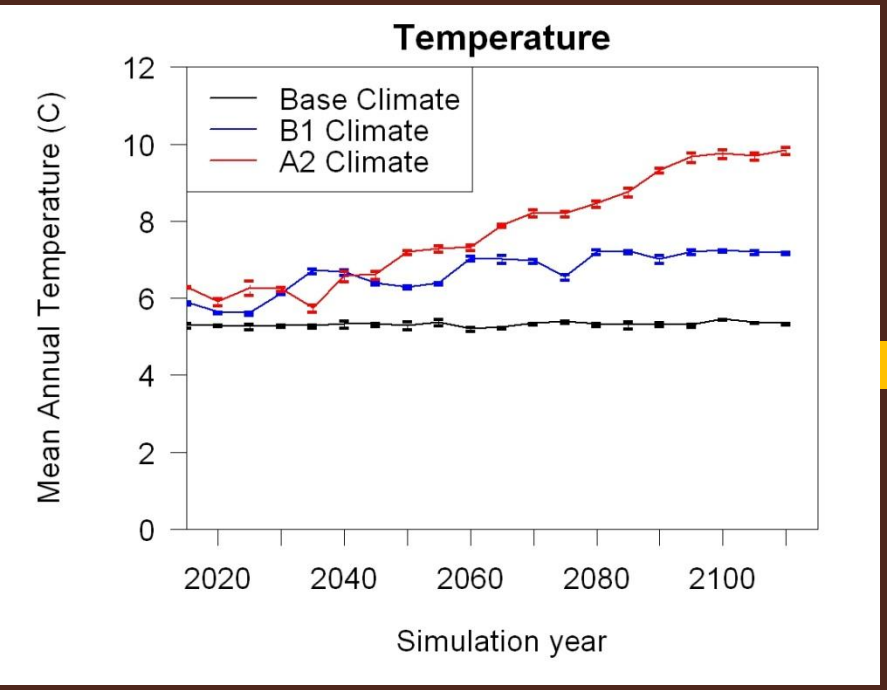


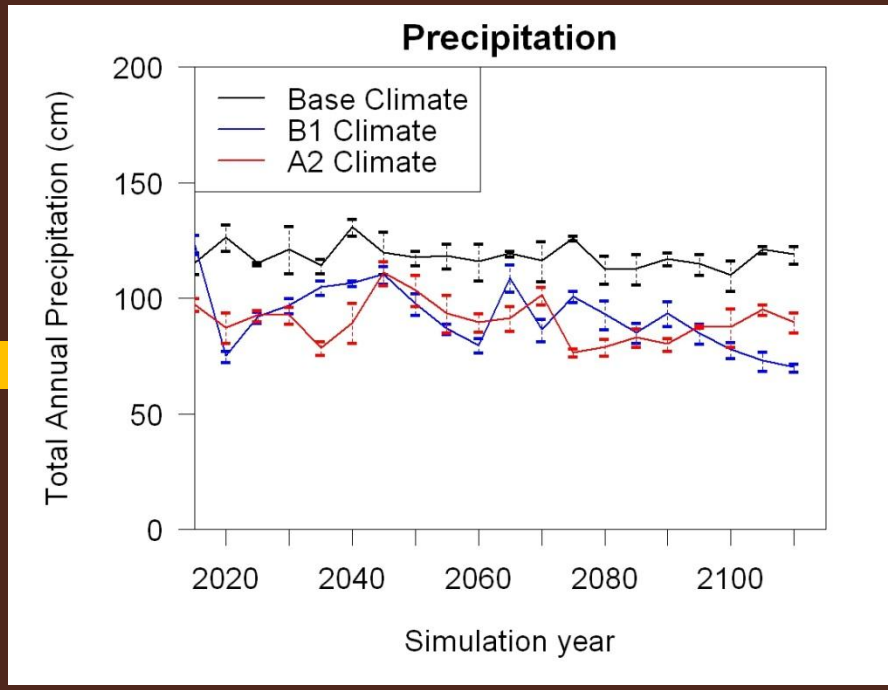
Fire

Forest Thinning

http://www.landis-ii.org/

Projected Changes in Climate





A2 Climate: 4° C increase in mean annual temp by 2100

Fire weather

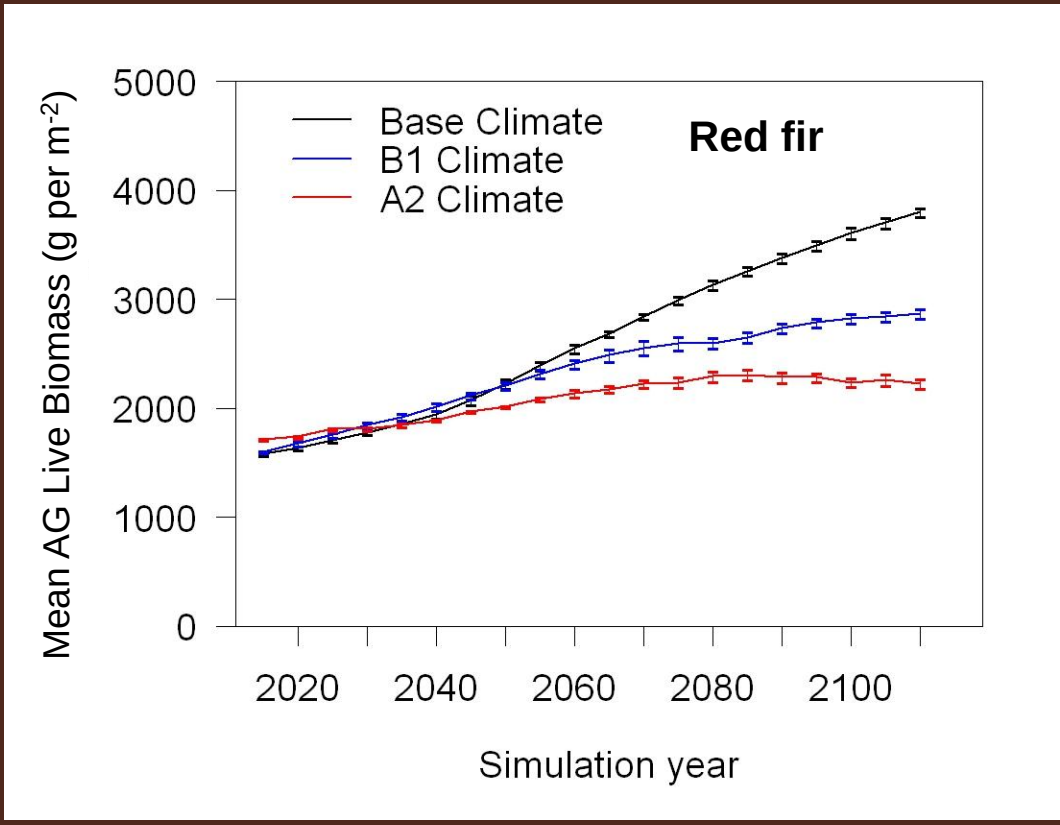
Tree growth & establishment

Data source: Coats, R., J. Reuter, M. Dettinger, J. Riverson, G. Sahoo, G. Schladow, B. Wolfe, and M. Costa-Cabral. 2010. The effects of climate change on Lake Tahoe in the 21st century: meteorology, hydrology, loading and lake response. UC Davis.

Climate Change & Subalpine Species

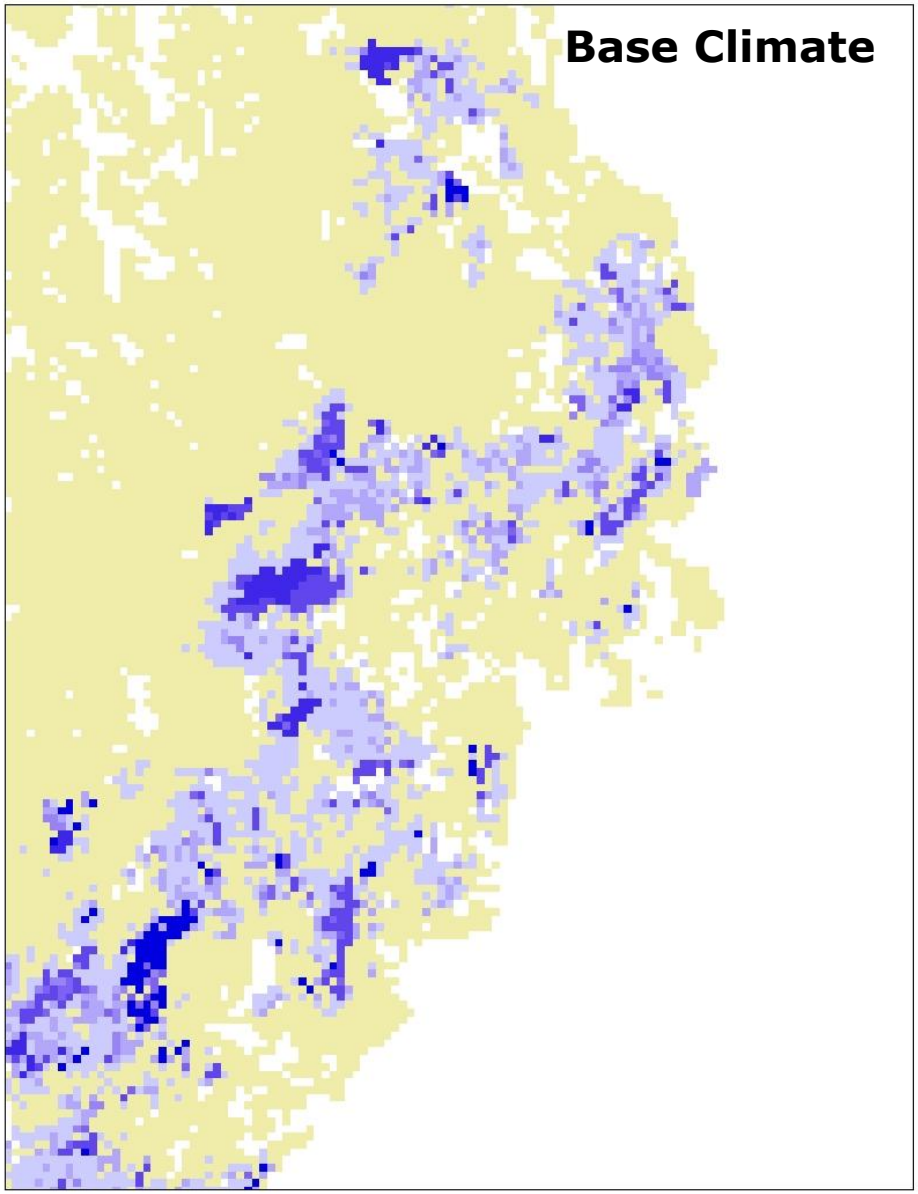
2° C ↑ (mean annual)

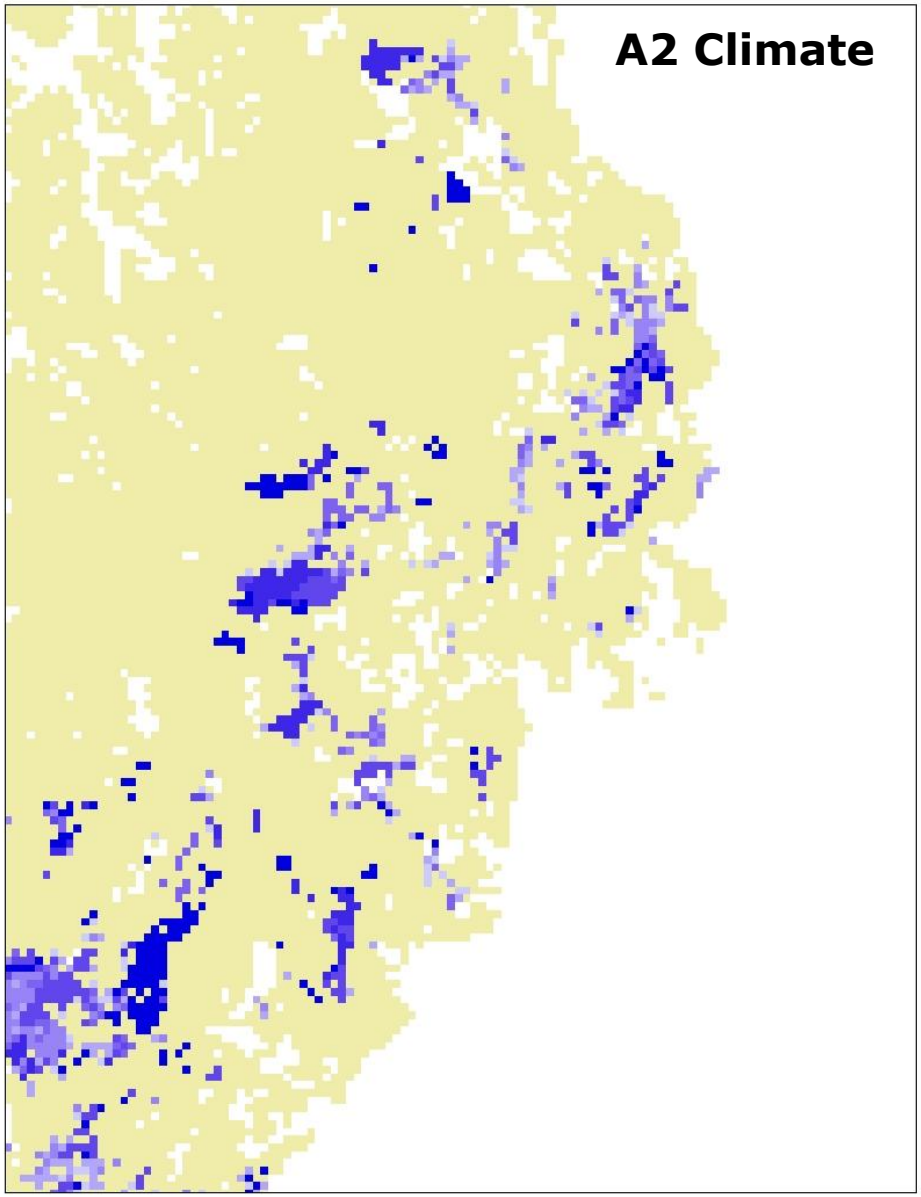
Establishment ability ↓



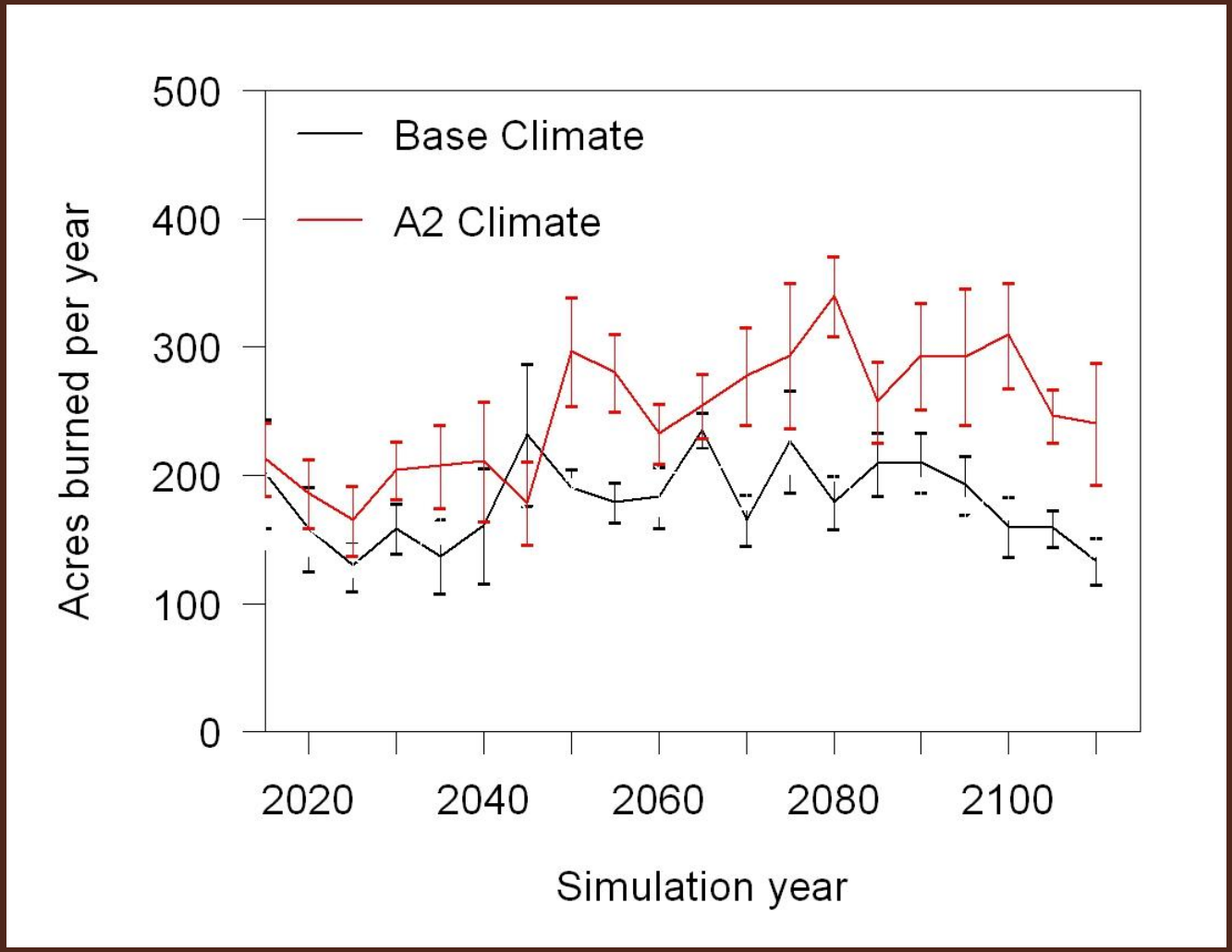
Red fir, Lodgepole pine, Western white pine, Whitebark pine, Mtn. Hemlock

Red fir – yr 2110

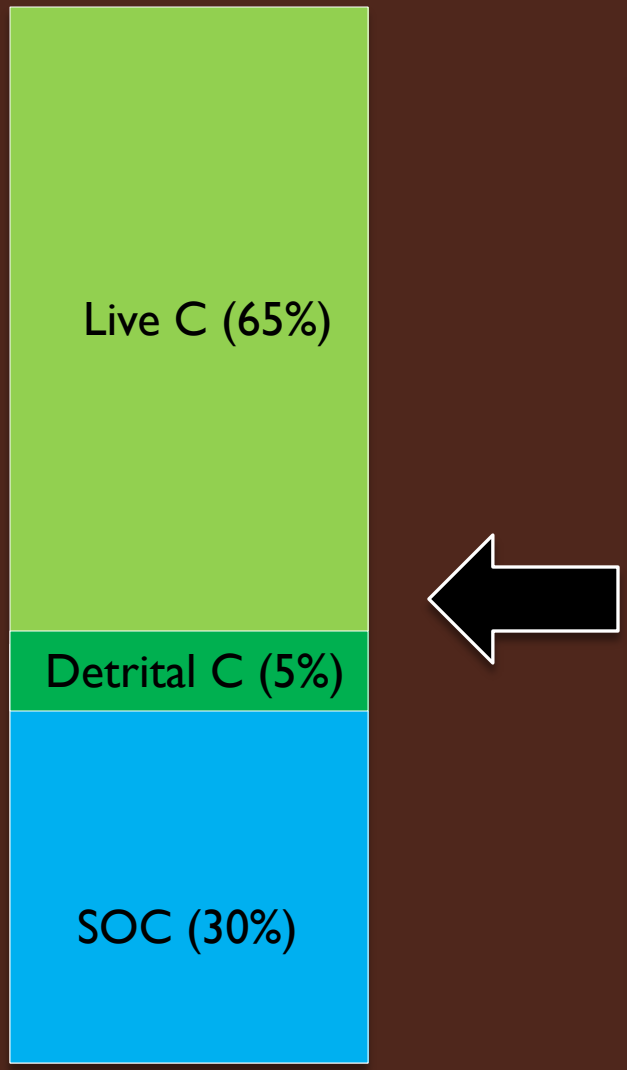


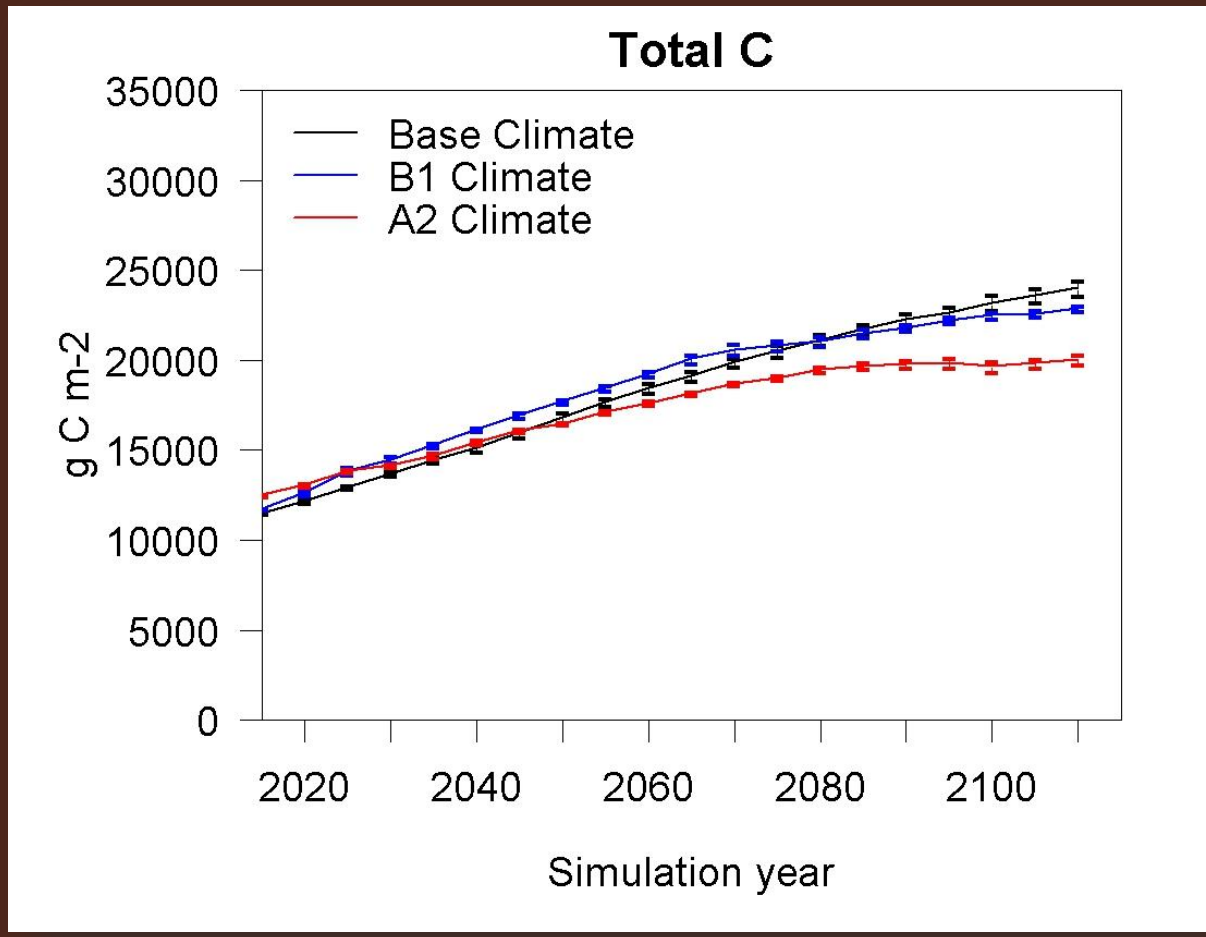


Wildfire Activity

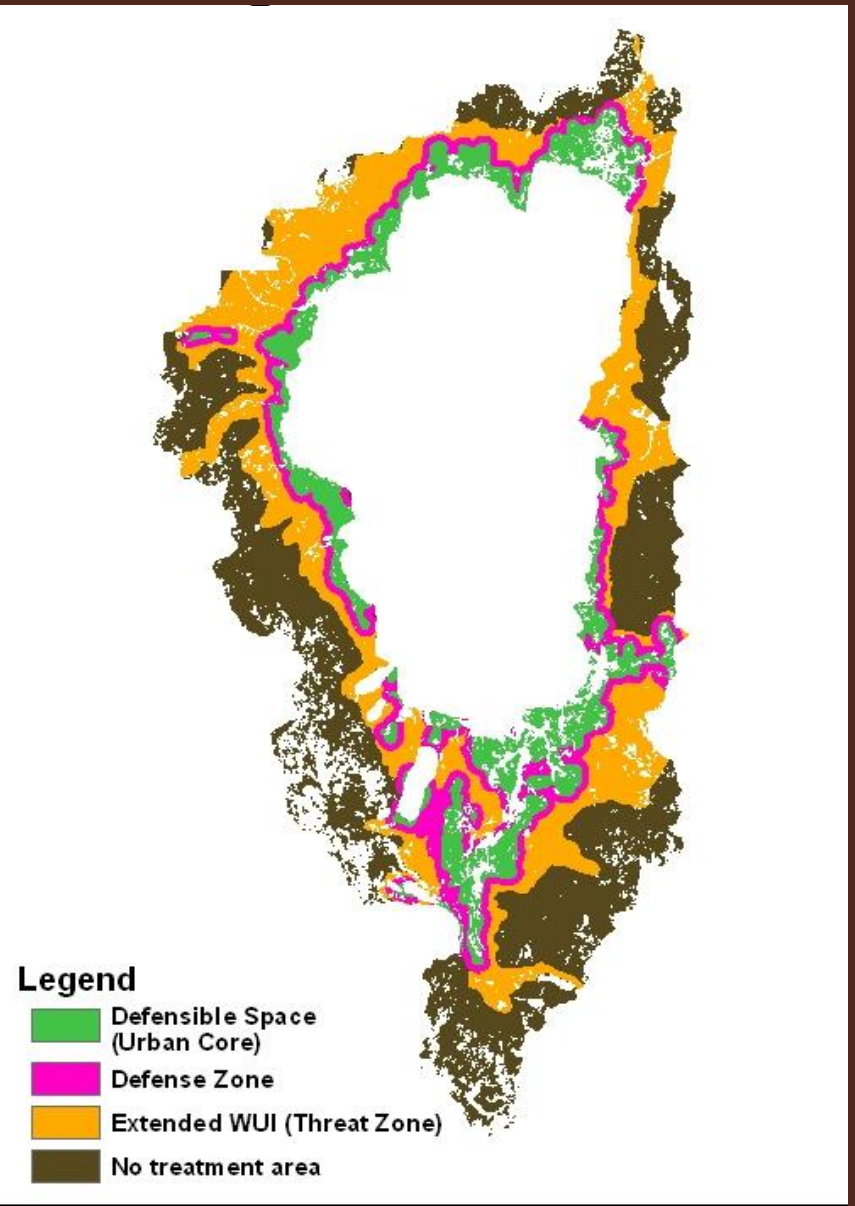


Landscape Carbon Dynamics





Fuel Treatment Scenarios



1) Long-Term Urban Core

2) Continued Fuel Treatment Intensity:

----- 15 & 30 yr. rotation pd.

X

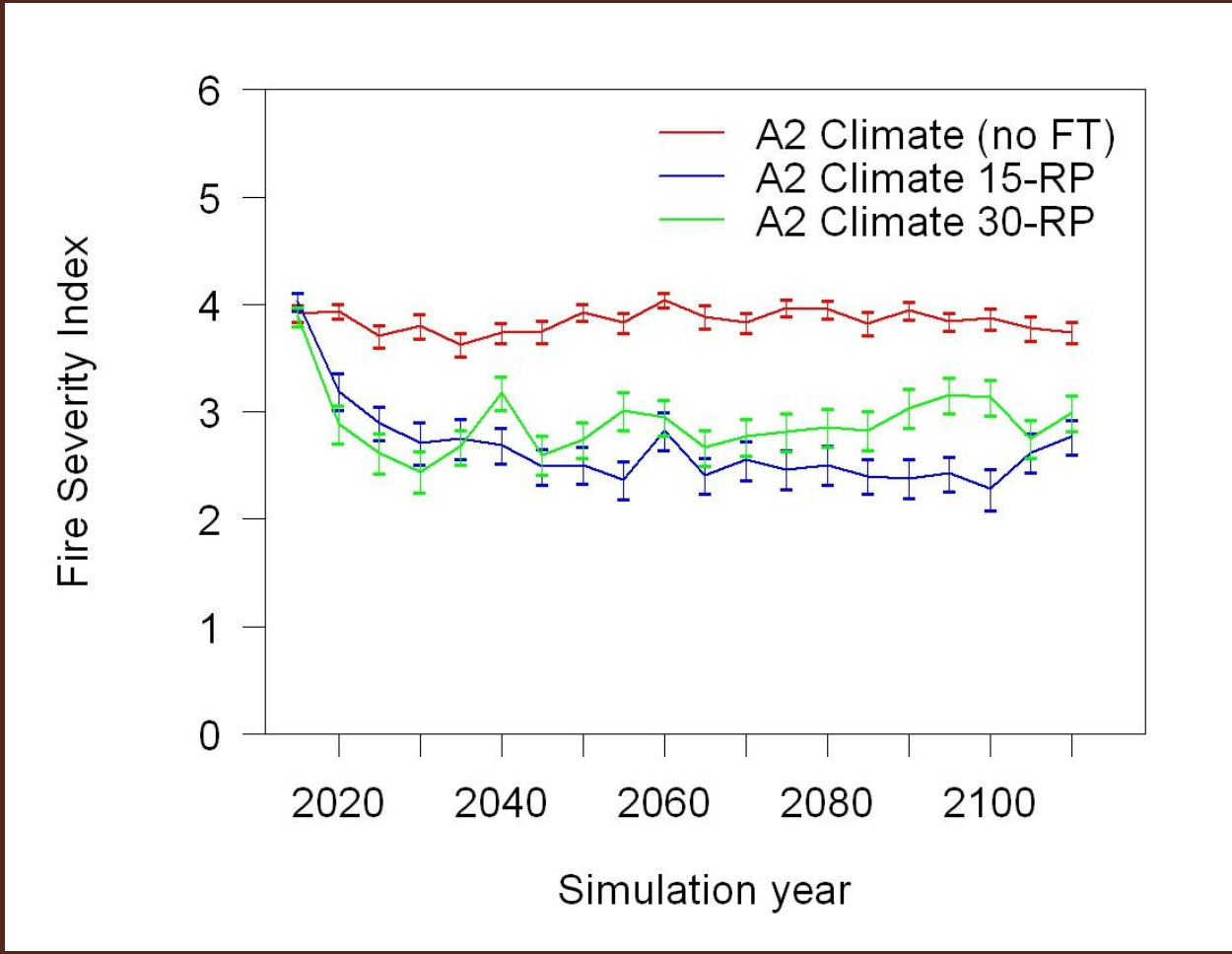
Climate Scenarios

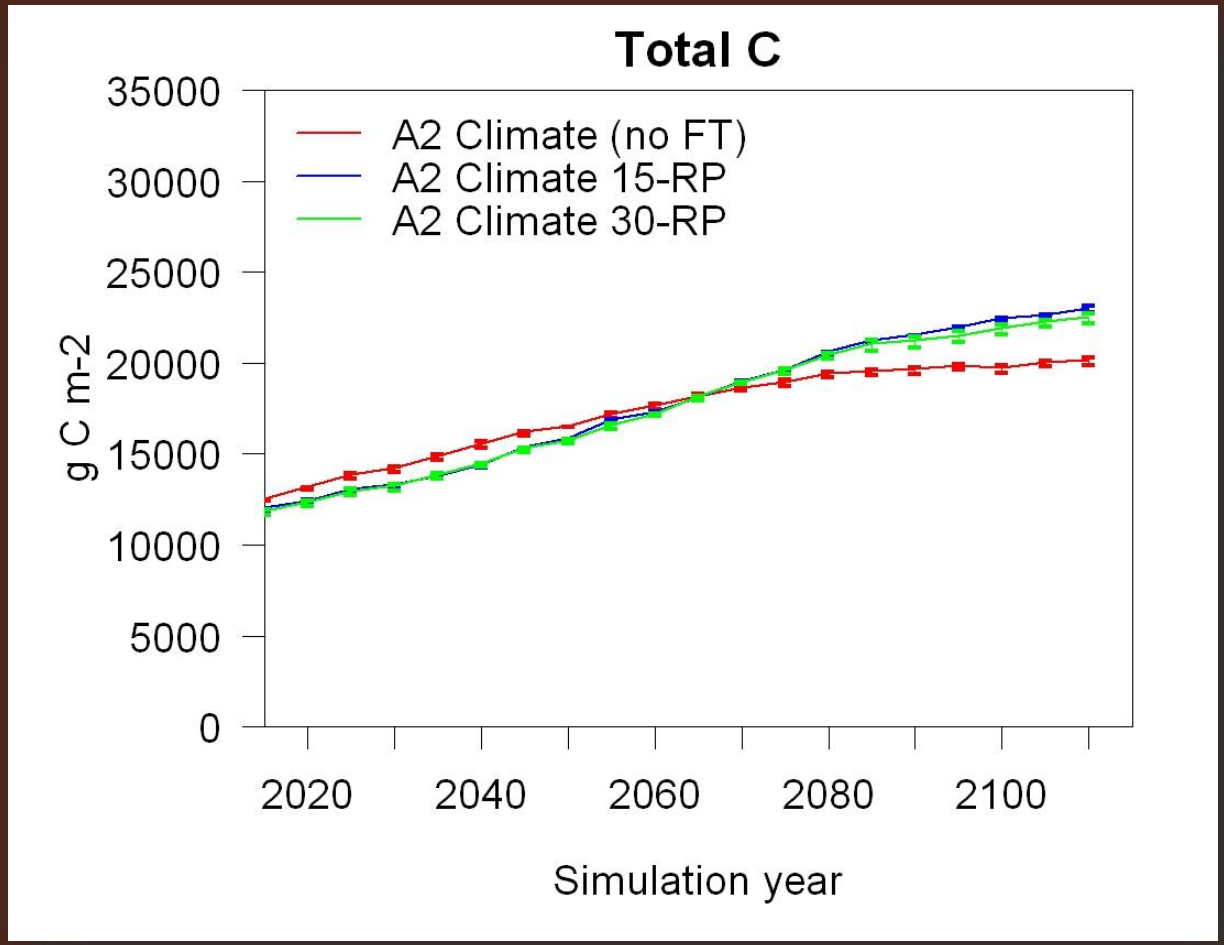
Base Climate

B1

A2

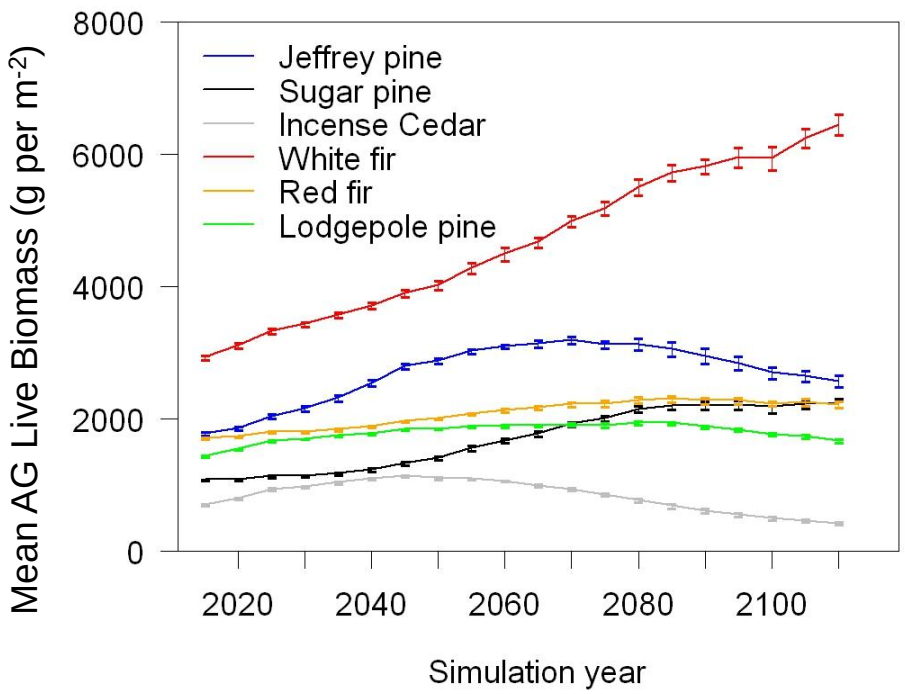
Fire Severity



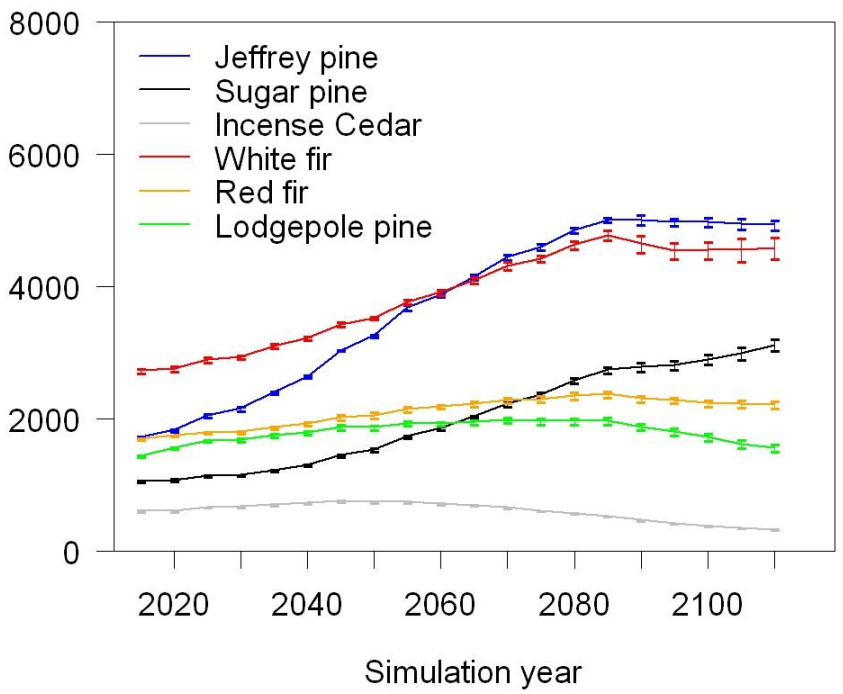

Total C
A2 Climate (no FT)
A2 Climate 15-RP
A2 Climate 30-RP
35000
30000
25000
20000
15000
10000
5000
0
g C m-2
2020
2040
2060
2080
2100
Simulation year

A2 Climate

No Fuel Treatments

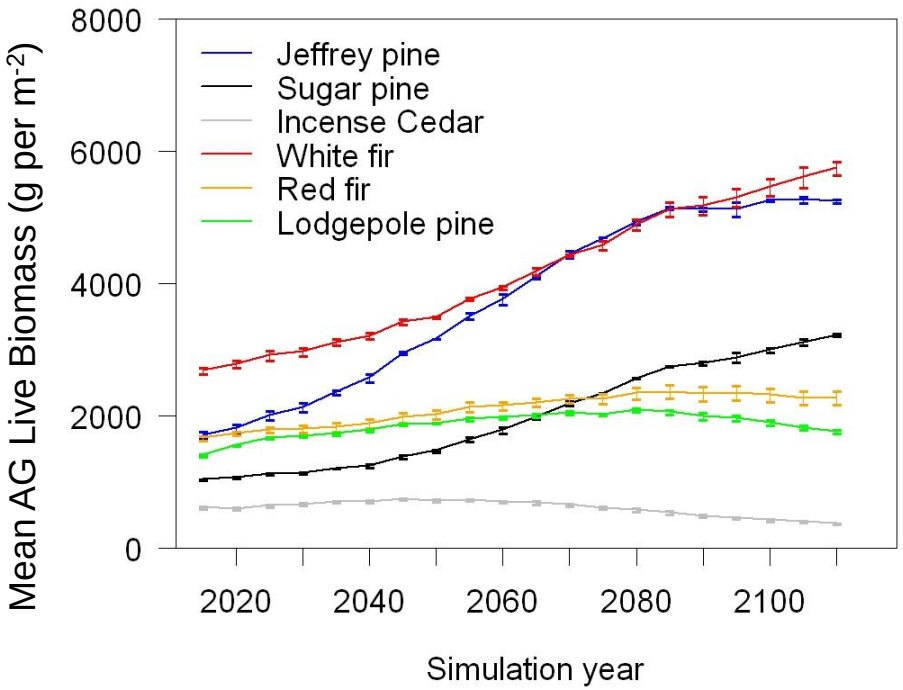


Fuel Treatments 15 - RP

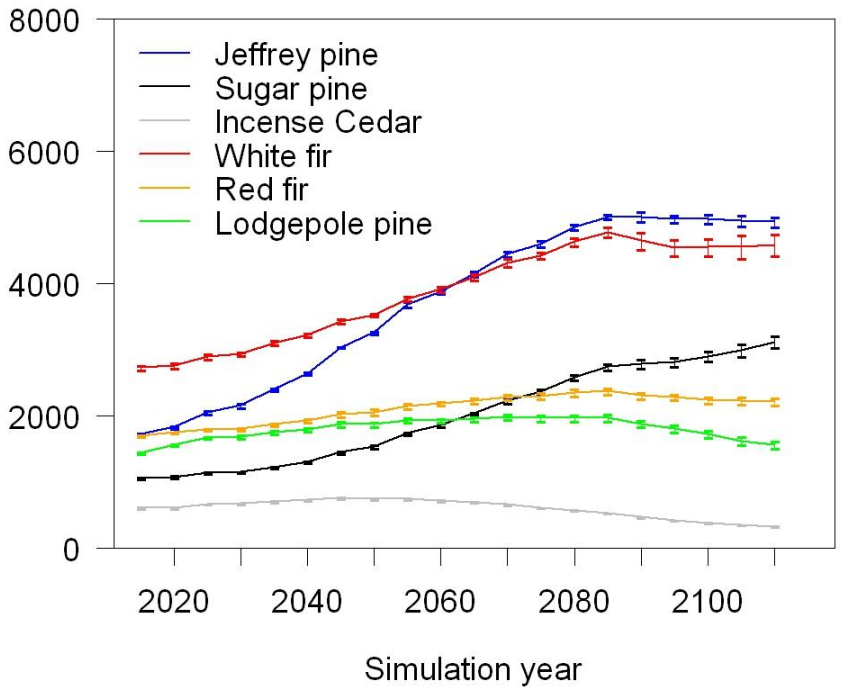


A2 Climate

Fuel Treatments 30-RP



Fuel Treatments 15 - RP



Strategic Placement: Long Term Urban Core

FT Scenario	Change in Wildfire
• Continuous FT 15 RP	• ~50-75% reduction in area burned
• Long Term Urban Core	• ~25-50% reduction in area burned

Both have similar reduction in Fire Severity!

Ignition Modeling

Jian Yang, UNR
Peter Weisberg, UNR

Ignition Density Modeling

Ignition Density ~ Veg, Topo, Human factors, Climate, Lightning density

- Spatial Point Pattern Modeling & 2-step model averaging

25% - Lightning-caused fires
75% - Human-caused fires

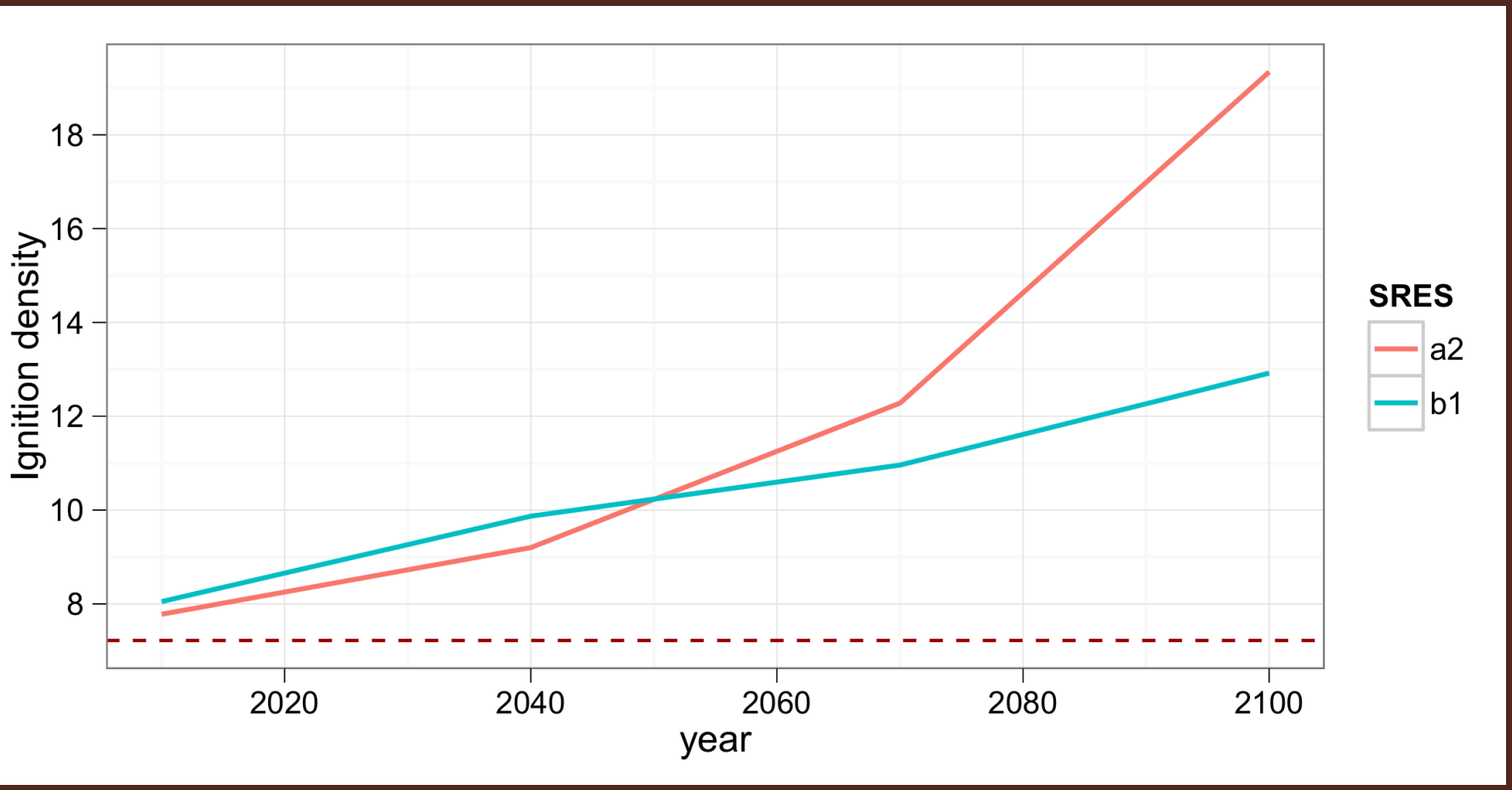
LANDIS-II LTB Model

Temporal Ignition No.s

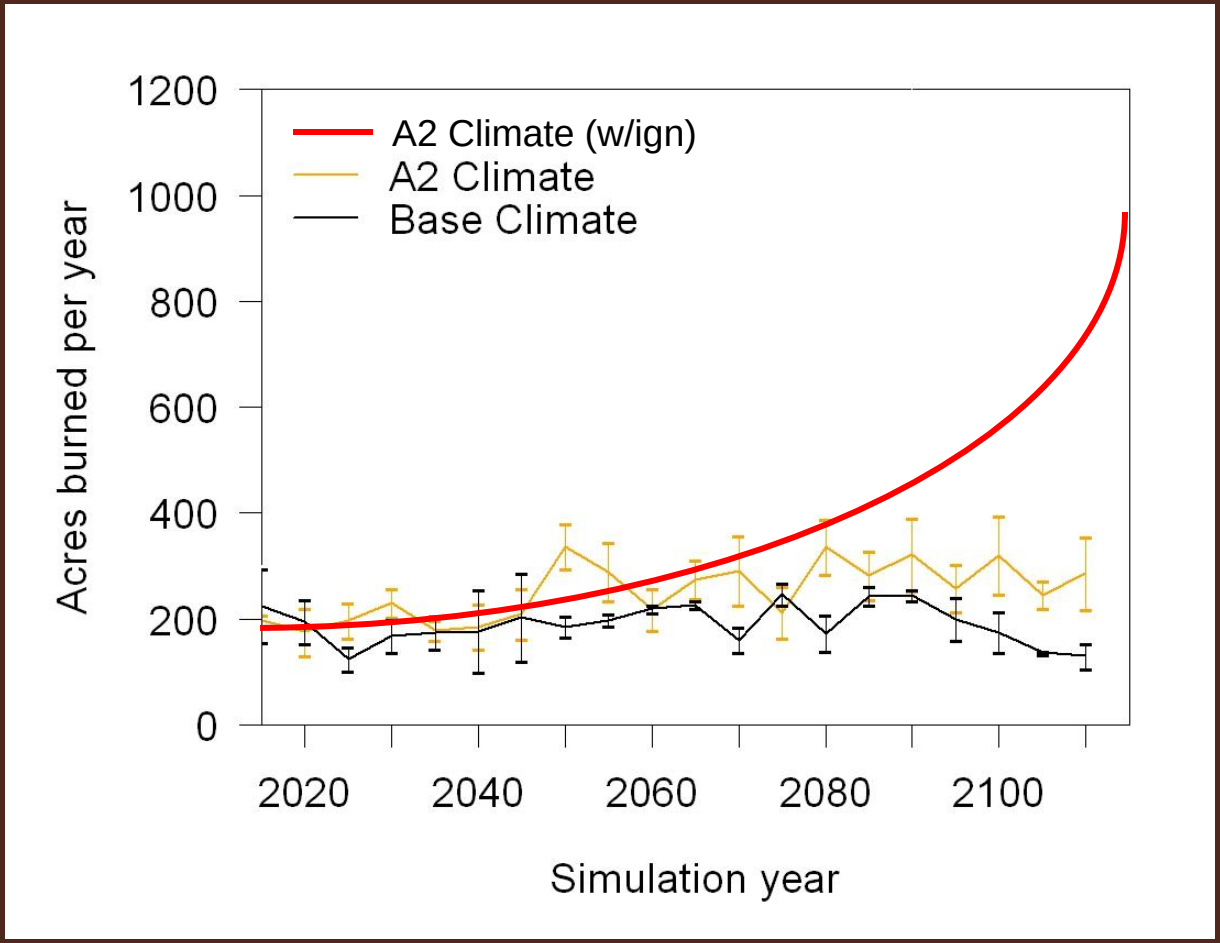
Current & Future Climate

Ignition Density Predictions

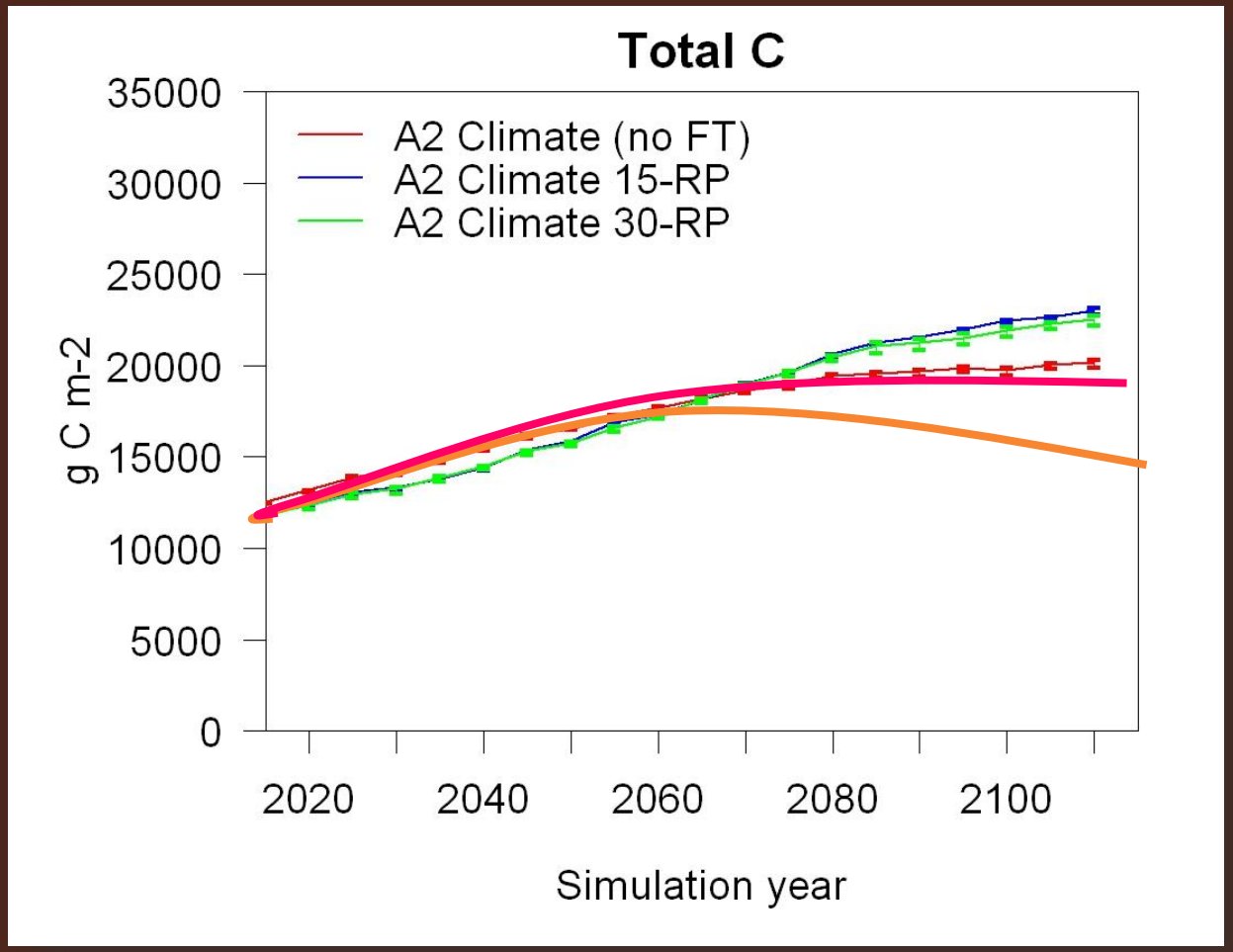
- # ignitions / 100 km² / decade



Climate Change & Increased Ignitions



Climate Change & Increased Ignitions



A2 w/ign & FTs

A2 w/ign

Conclusions

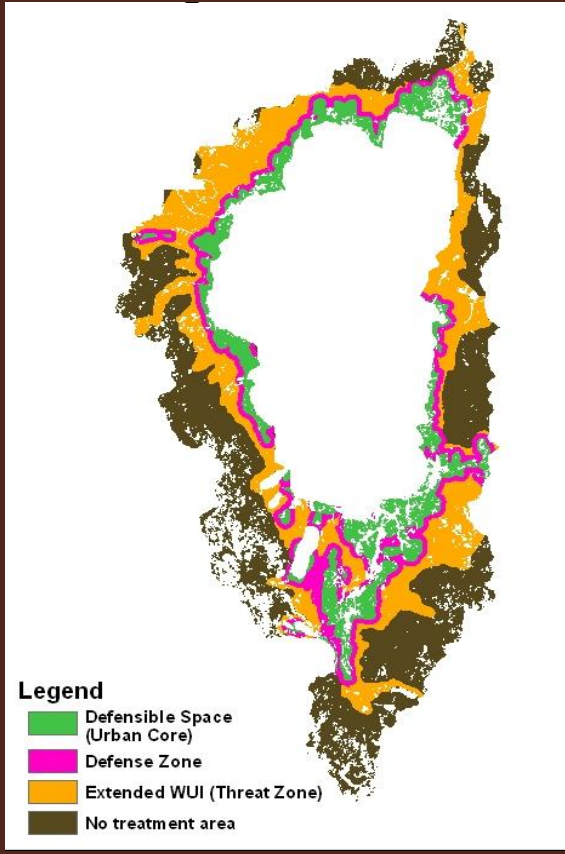
- Forest may remain C sink regardless changes in climate
  - "Landscape legacy" effects
- 2°+ C ↑ temperature ~ ↓ estab. of subalpine species
- Increased wildfire activity (CC) may accelerate impacts of climate change on forest C & species

Can fuel treatments mitigate for climate change?

- Strategic placement (i.e., defensible space) vs. Area Treated vs. Intensity (15 vs. 30 RP)

- Mgt. may be able to mitigate for climate change
  - Climate resilience ~ Fire resilience
  - Caveat: direct impacts of CC

- Increased ignitions
  - Fuel treatment effectiveness is unclear
  - Intersection of treatment & wildfires



Thank You!