After the smoke cleared: Vegetation recovery after the Angora Fire

Tahoe Science Conference, May 23, 2012




Chris Carlson[1]

Hugh Safford[2,3]

Solomon Dobrowski[1]

[1] University of Montana, Department of Forest Management, Landscape ecology lab

[2] USFS Pacific Southwest Research Station

[3] UC Davis, Department of Environmental Science and Policy

Research Questions:

- How did wildfire affect vegetation?
  - Natural and management related variation in fire severity
  - Changes in carbon storage
- How has vegetation responded?
  - Fuel accumulation
  - Tree regeneration
  - Understory recovery
- Long-term implications?
  - Vegetation recovery after historical fires in area
  - Carbon recovery

Background – Site Description

- Mixed conifer forest + chaparral
  - Jeffrey pine, White fir, Incense cedar
  - Red fir series on upper slopes, ridges
  - Quaking aspen, willow, lodgepole along creeks/seeps
  - Montane chaparral
  - Influence of both East side and West slope vegetation
  - Mix of quaternary, granitic and metamorphic substrates

- History of logging, grazing, development, fire suppression, fuel reduction treatments, post-fire management

History of vegetation change:

Last recorded wildfire: 1882

Comstock logging in 1890's

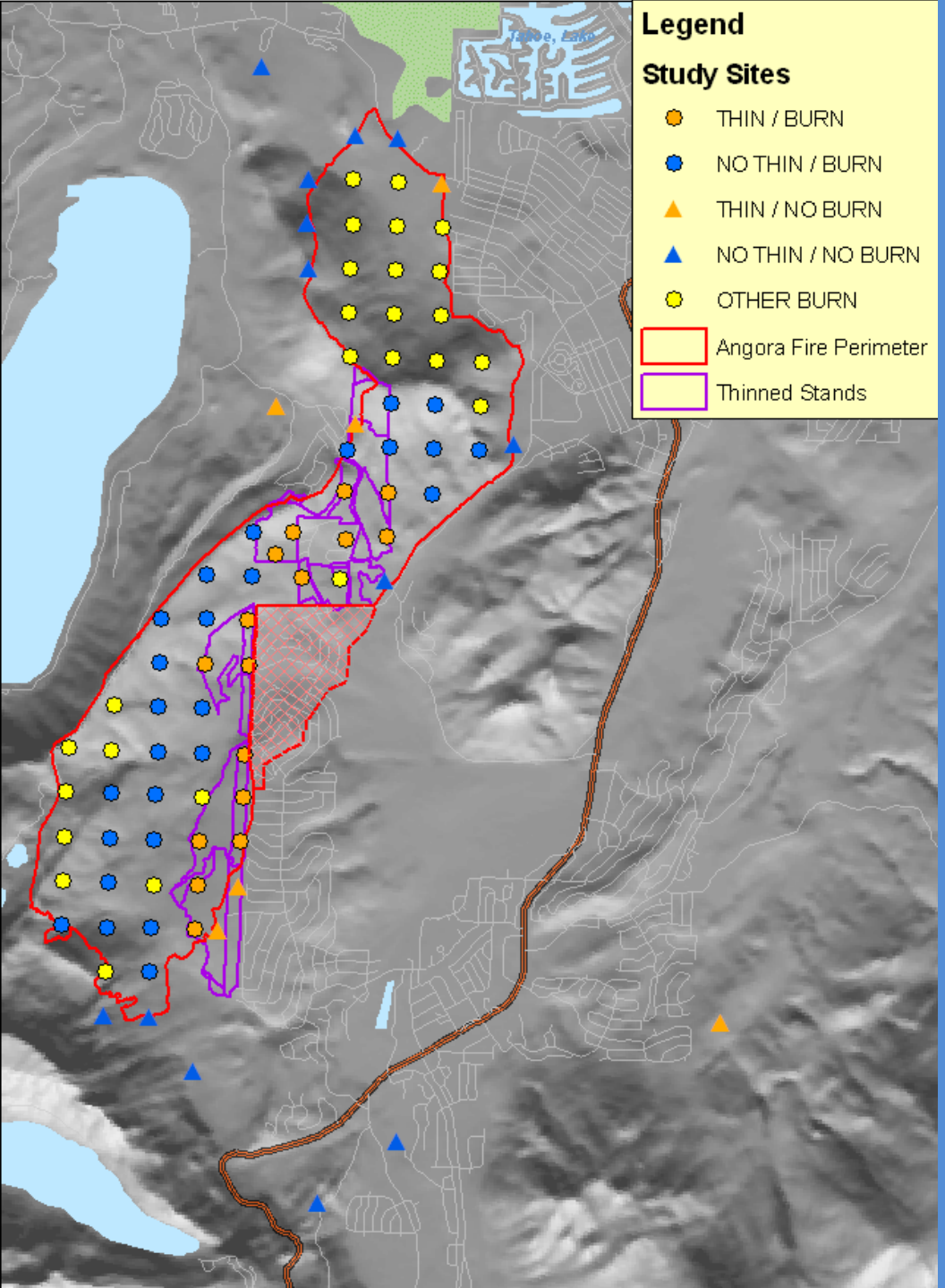
Grazing through 1950s

Fuel reduction treatments, 1998-2007

Wildfire: 2007

Post-fire management: On-going

- 1939
- 2004
- 2007
- 2010



Methods – Data Collection

- 86 1/5th acre CSE plots (see left)
- 200+ 1/70th acre regeneration plots (see next page)
- Collected detailed tree, fuels, species composition at Common Stand exam plots in 2008-2010, and regeneration data in 2008-2011

- **Common stand exam plots (400m spacing)**

  Surveyed 3 years (and in 2012)

  n=68 burned, 18 unburned plots

  13 plots treated for fuels 2000-2007

  26 nearby plots not treated for fuels

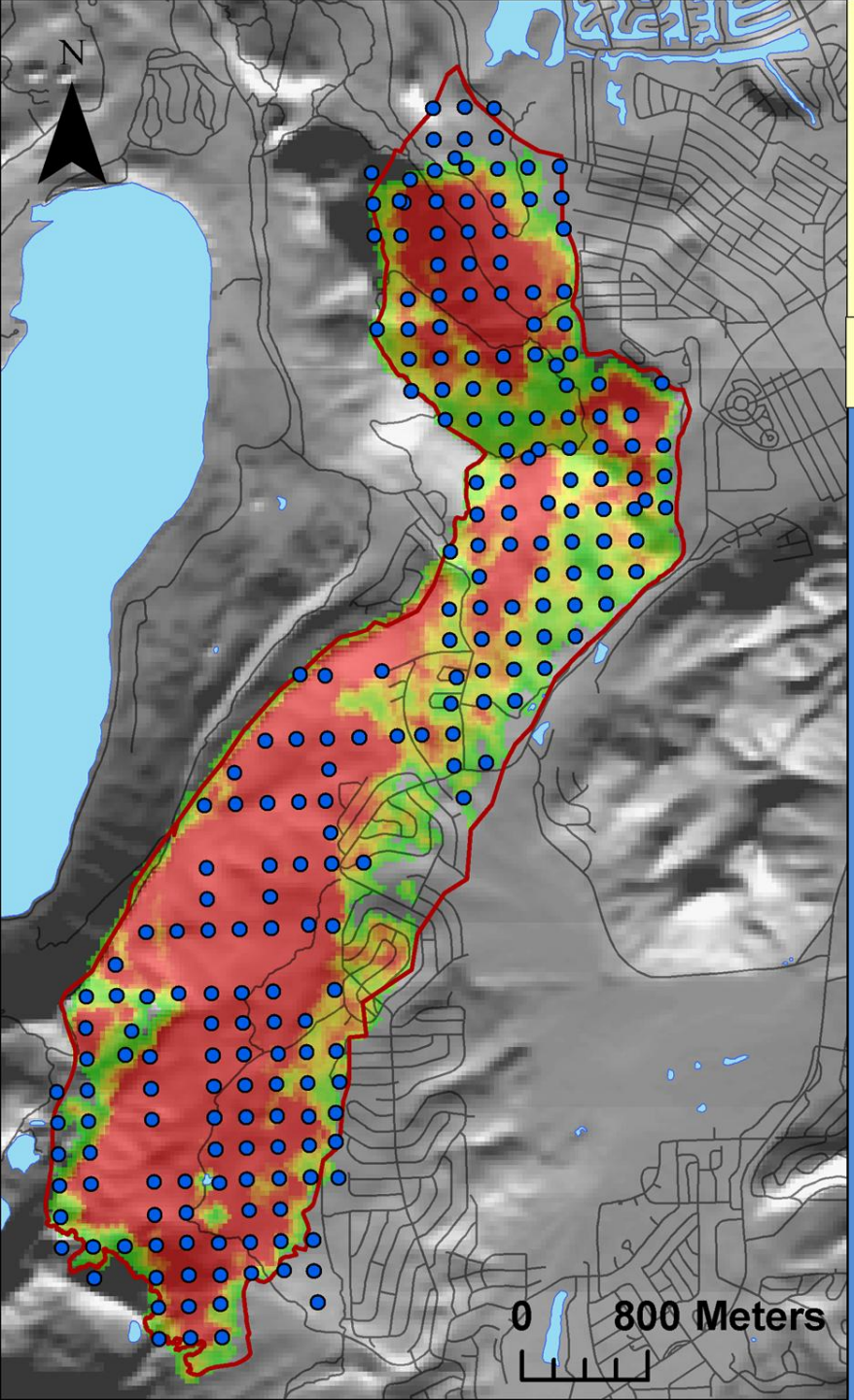
  29 "other' burned plots

- **Regeneration plots (200m spacing)**

  n=204 plots surveyed all 4 years

Methods – Data Collection

Fire severity and Regeneration Plot Map



- Angora Fire of 2007
- June 24, relatively early season
- High winds, dry conditions, >95th %ile fire danger for the date
- Burned 2000 acres (2/3 of total area) in first 24 hours
- High Severity fire across ~1/2 of burn area

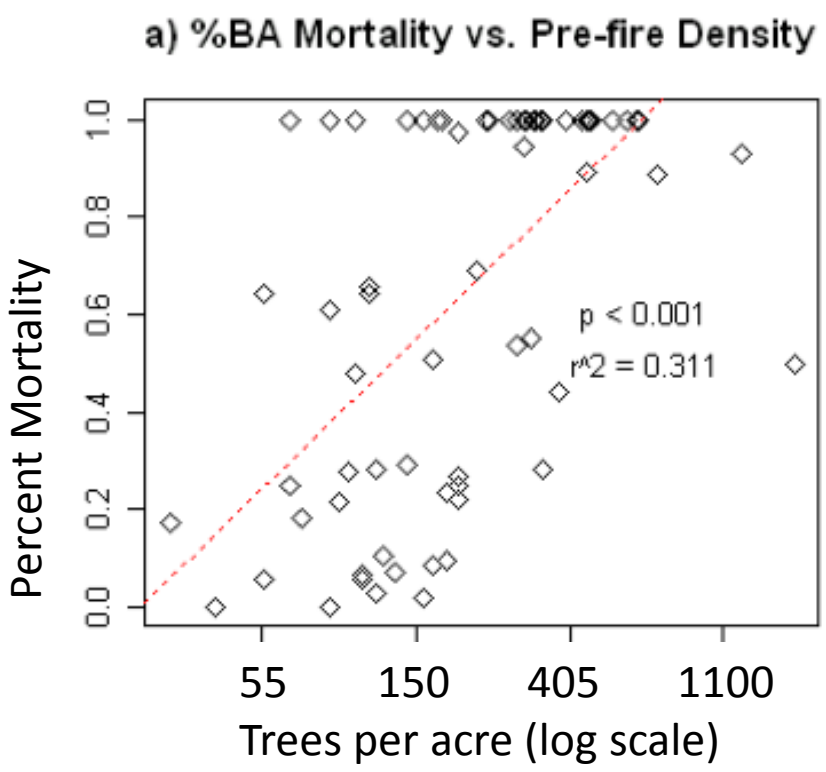
Results: How did wildfire affect vegetation?

– Naturally occurring variation in fire severity

Mortality rates correlated with pre-fire stem density

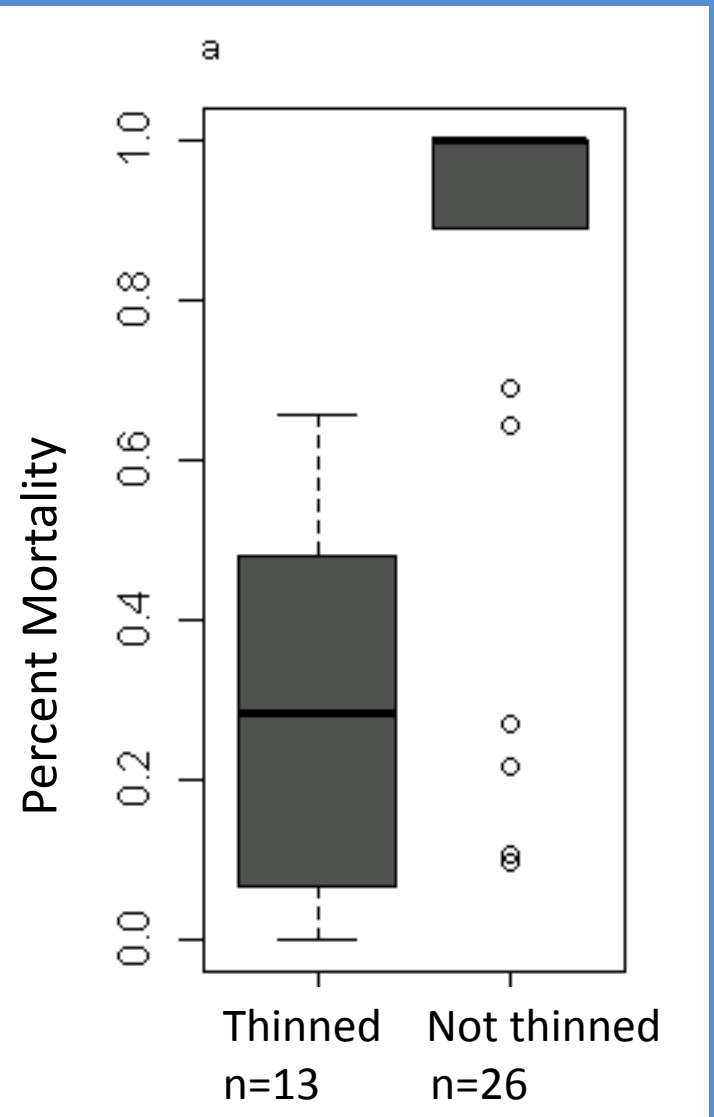
$p < 0.001$, $r^2 = 0.311$

And skewed towards high mortality, variation in mortality across spatial and temporal scales



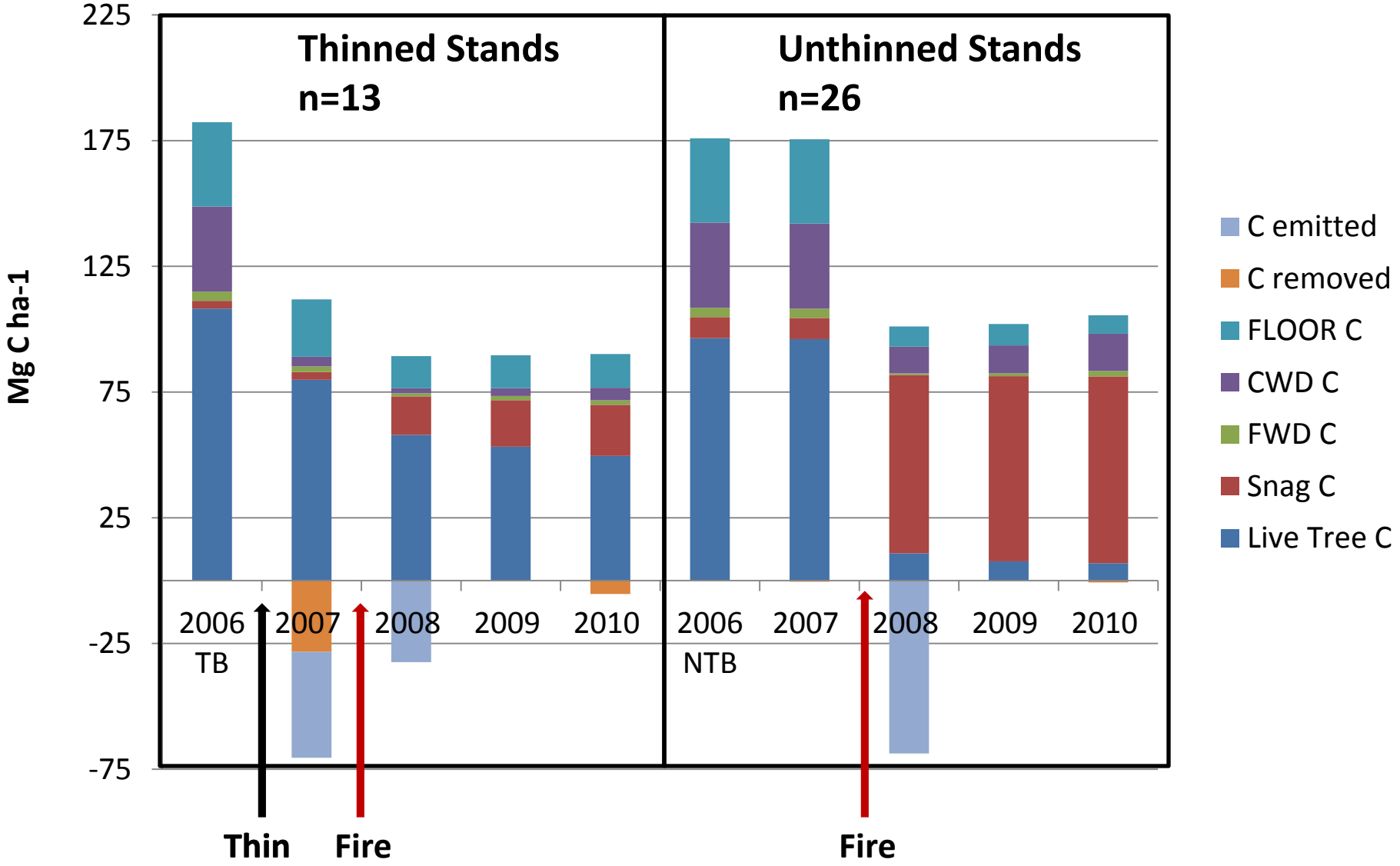
Results: How did wildfire affect vegetation?

- Variation in fire severity related to pre-fire management



Safford, Knapp and Carlson. 2009. Forest Ecology and Management 258.

Results –Effects of thinning, wildfire on Carbon storage in the Angora burn area



Carlson, Dobrowski and Safford. In press. Carbon Balance and Management.

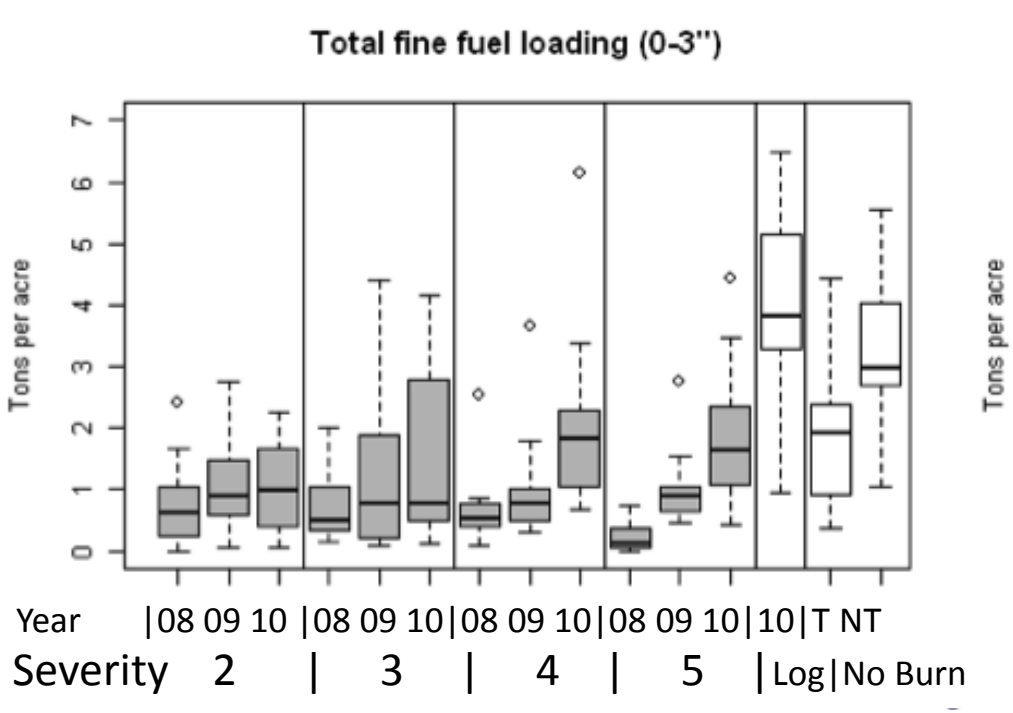
2008, after intense surface fire, no crown fire.
100% mortality, 75% White Fir. Plot 4.

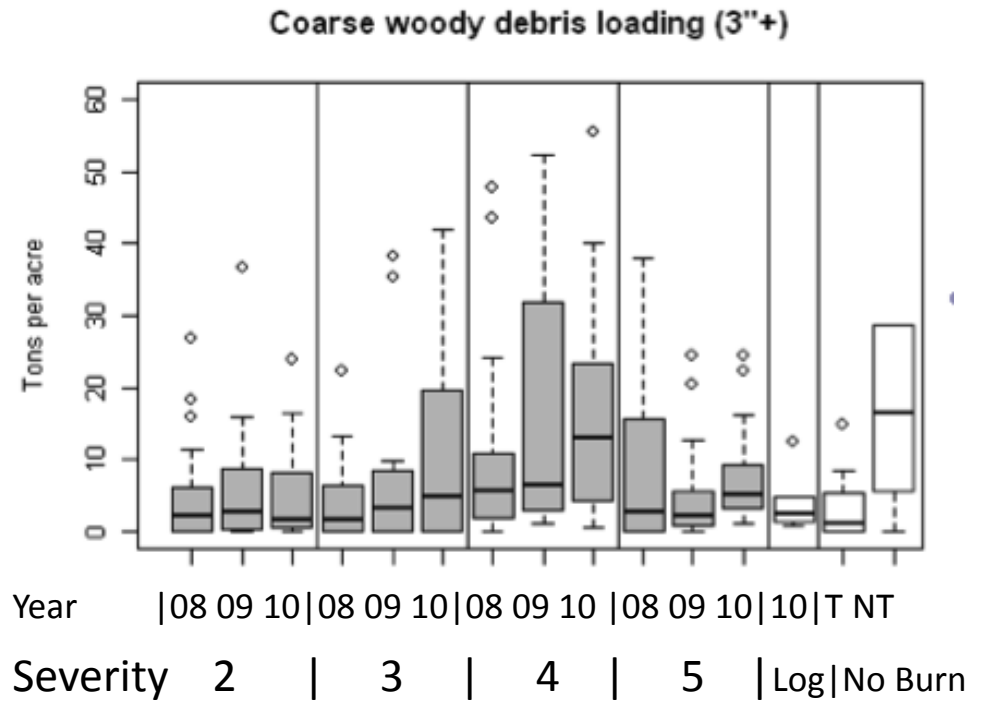
Results: How has vegetation responded?

– Fuel accumulation

As compared to outside the fire

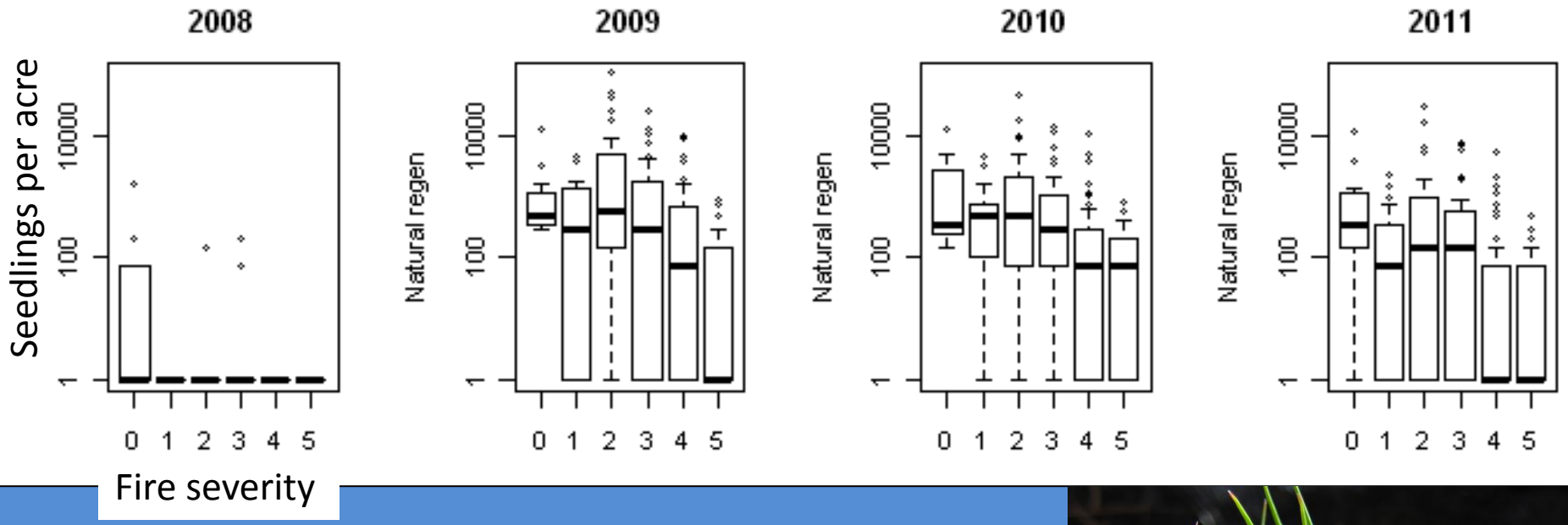
Less coarse woody, more fine woody debris in logged areas (n=5)





Results: How has vegetation responded? -

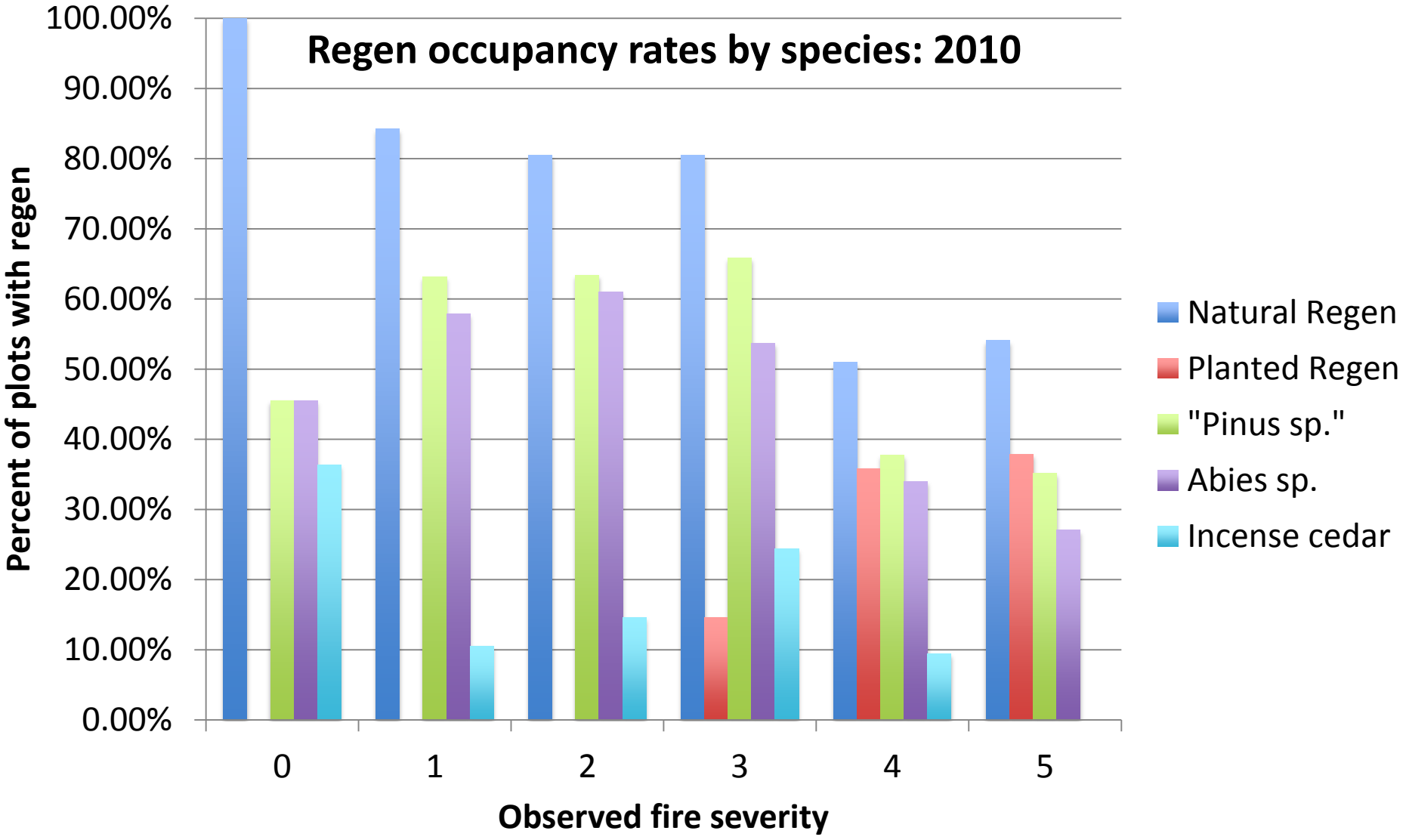
All Natural tree Regeneration

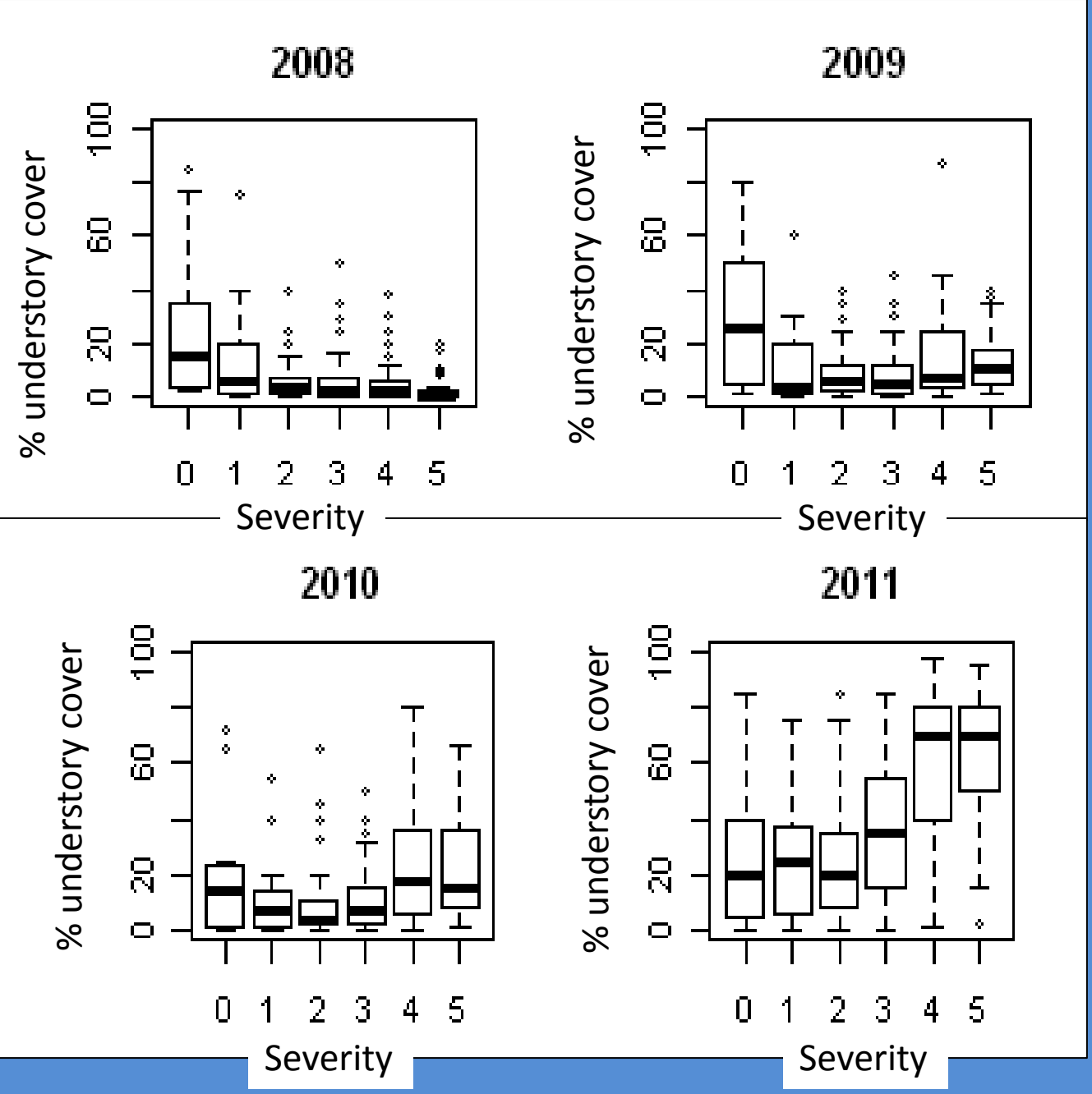


- Flush of White and Red fir in 2009, Jeffrey and Sugar pine in 2010.
- Lots of seedling turnover.

Results: How has vegetation responded?

~50% seedling occupancy in severely burned stands





Results: How has vegetation responded?

Shrubs becoming dominant canopy by year 4, 0.5 meters tall in high severity.

Highest richness (20 species per plot) in low and moderate severities.

Mean = 16 species per plot in high severity

2008, Plot 44. Fire Severity 5. Footslope of Angora ridge

2008, 20% Slope, 300m below Angora Ridge Road, Plot 18, had some regen but it died.

FIG. 7. Photo pair showing conversion of chaparral to forest at the Fallen Leaf site between the period 1915 (top) and 2000 (bottom).

Long term implications?

Nagel and Taylor (2005) surveyed montane chaparral in the Basin created by fires in late 1800's.

Trees continued recruiting for 7 decades after fire

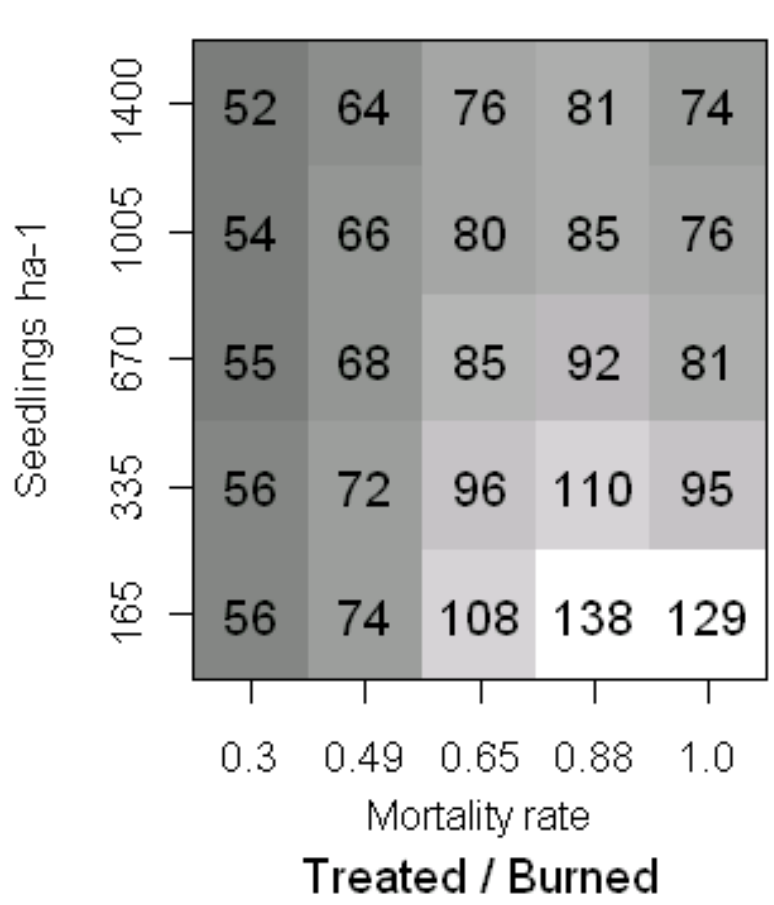
30 years for *A. concolor* to overtop shrubs

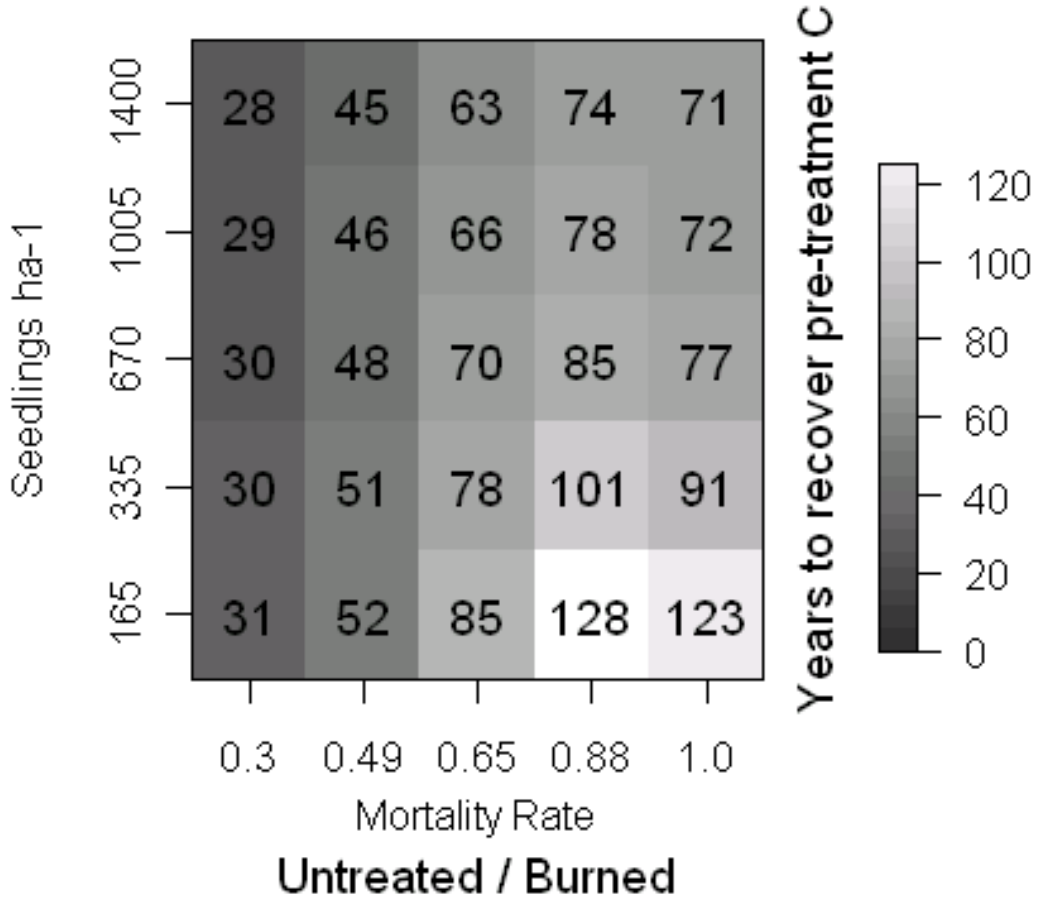
Chaparral area shrunk by >60% over 120 years

T.A. Nagel and A.H. Taylor, 2005. Journal of the Torrey Botanical Society, 132(3).

- Long-term implications?
  - Carbon recovery

Years to recover pre-fuel treatment carbon storage (175 tons ha-1), at five levels of tree mortality, and regeneration





Carlson, Dobrowski and Safford. In press. Carbon Balance and Management.

Thanks!

Funding provided by LTBMU, with support from SNPLMA

University of Montana College of Forestry and Conservation staff

LTBMU Staff

Field support:

Brennon Touryon

Adam Brigham

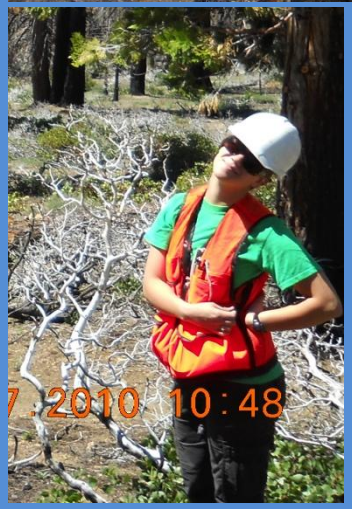
Emily Okal

Amy Brodbeck

Marcel Safford

Kevin Welch

and others



Questions?

See also:

C.H. Carlson, S.D. Dobrowski, H.D. Safford. In press. *Variation in tree mortality and regeneration affect forest carbon recovery following fuel treatments and wildfire in the Lake Tahoe Basin, California, USA.* **Carbon Balance and Management (www.cbmjournal.com)**

Annual Progress reports, 2009-2011, summarizing and reporting rates of mortality, regeneration, fuels, etc., posted at:

University of Montana Forest Landscape Ecology Lab, and on file with the LTBMU
www.cfc.umt.edu/forestlandscapeecologylab/Publications/

chcarlson@gmail.com