Effects of low-severity fire on structural attributes and radial tree growth in *Abies concolor*-dominated forest, Yosemite National Park, CA

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**Background**

- European settlers began suppressing fire in all forested systems at the onset of the colonization of the West to protect built human structures as well as the valuable timber that is stored in forests.
- In 1968 it was discovered that suppressing fire in these ecosystems was actually detrimental to forest health. Fire suppression resulted in higher stand density, which increased risk of high-severity fire and competition for resources such as water, light, and nutrients.
- Yosemite National Park (YNP) introduced a fire management plan to the park in 1972. However, the effects of the reintroduction of fire on forest structure and radial tree growth are still not well understood.

**Study Sites**

- **Unburned Plot**
- **Burned Plot**

**Results**

- Stand basal area and density did not vary widely between burned plots in the 7-year post-fire interval.
- Stand basal was noticeably higher in the Unburned Control than in Burned Plots, and most strikingly stand density was around 3 times higher in the Unburned Control than in the Burned Plots.

**Research Questions**

Q. How does forest structure vary...  
1. Between burned and unburned sites?  
2. Between sites burned at different severities?

Q. How does radial tree growth vary...  
1. Between burned and unburned sites?  
2. Between sites burned at different severities?

**Structural Differences Associated with Fire**

**Methods**

- Data were collected during the summer of 2011.
- Diameter at breast height, tree species, and mortality status were recorded.
- Live tree and snag species composition represented by:
  - Basal area
  - Density

**Results**

- Live tree basal area and density did not vary widely between burned plots in the 7-year post-fire interval.
- Stand basal was noticeably higher in the Unburned Control than in Burned Plots, and most strikingly stand density was around 3 times higher in the Unburned Control than in the Burned Plots.

**Radial Tree Growth Response to Fire**

**Methods**

- Two cores to pith were taken from 10 representative trees in each plot.
- Ring-width values were used to create Basal Area Indices (BAI) from 1970-2010.
- T-tests were used to identify significant differences between pre-fire (2000-2004) and post-fire (2006-2010) growth means within individual plots as well as between Burned 1, Burned 2, and the Unburned Control.

**Results**

- Both Burned Plot 2 (*p=0.07*) and the Unburned Control (*p=0.1*) had a significantly lower mean growth rates in post-fire years than in pre-fire years.
- Burned Plot 1 did not have a significantly different growth rate between pre- and post-fire years; nor were there significant differences in mean growth rates between any of the plots in post-fire years.

**Significance**

- Structural results show that low-severity fire in *A. concolor*-dominated stands is effective at reducing live tree density and decreasing basal area. Also, the higher snag density in Burned Plot 1, the plot burned at higher severity, suggests that fire at a dNBR of 112 is effective at killing small diameter trees, thereby reducing resource competition between larger diameter trees.
- The significantly lower post-fire mean growth rate in the Unburned Control suggests that post-fire climate was unfavorable to tree growth. As Burned Plot 2 also exhibited lower growth rates post-fire we can infer that fire at a dNBR of 72 may not influence tree growth rates. However, as Burned Plot 1 did not exhibit a significant reduction in growth between pre- and post-fire years we can infer that fire at a dNBR of 112 may be effective in increasing tree growth rates. This is important when calculating the carbon budget associated with fire.
- The results of this study may be used by land managers to inform fire management plans for *A. concolor*-dominated stands in YNP.

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