Did Sudden Oak Death Mortality in Big Sur Worsen Wildfire Severity?

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Introduction

Coastal California forests have experienced extensive mortality since the mid-1990s due to the emergent forest pathogen *Phytophthora ramorum*, causal agent of Sudden Oak Death (SOD). Although the pathogen has a broad host range, mortality is concentrated in tanoak (*Lithocarpus densiflorus*) and several species of oak (*Quercus* spp.). These species form an important part of the redwood and mixed-evergreen forests that occur throughout California's forests and the urban-wildland interface.

The forests of Big Sur are among the most impacted by *P. ramorum* in California, with hundreds of thousands of trees dead across the region (Figure 1). In late June 2008, a large dry lightning storm ignited thousands of fires across California, where most of the state's forests were experiencing very dry conditions following two years of drought. The largest of these fires became the Basin-Indians Complex, which burned over 240,000 acres in Big Sur. This fire presented a rare opportunity to examine interactions between a large wildfire and a destructive biological invasion (Figure 2).

Research Question: Were the impacts of the Basin Fire more severe in areas that were affected by SOD because of increased fuel loads from SOD-caused tree mortality?

Figure 1: A hill slope in Big Sur dotted with tanoaks that have died from infection by *Phytophthora ramorum*.

Figure 2: East Andrew Molera State Park.

In 2006 (top) the area had high impacts from SOD, with many large dead tanoaks and piles of tanoak logs.

Damage from the 2008 Basin Fire (bottom) was quite severe in this area.

Methods

Long-term forest monitoring

A major goal of our ongoing research is to examine the changes in the forest community and environment that might result in positive or negative feedback between the pathogen, its various hosts and the physical environment. Within this framework we have established 280 intensive long-term monitoring plots randomly distributed across the Big Sur area in two forest types (Figure 3). In each plot we have quantified disease incidence, levels of tree mortality, amount of coarse woody debris and various other biological and physical characteristics of the forest.

Figure 3: Ninety-eight of the 280 monitoring plots in our network burned during the Basin Fire.

Figure 4: Basin Complex Wildfire as viewed from Botcher's Gap near the Ventana Wilderness; July 9, 2008.

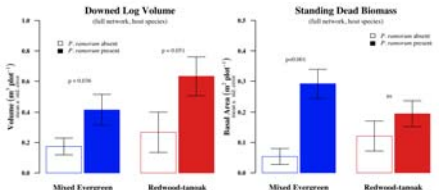
Burn Severity Rapid Response Survey

Following containment of the wildfire, we surveyed burn severity in 61 plots within the Basin Complex Fire perimeter. Live and dead biomass in these plots spanned the range of tree densities and fuel loads observed across the entire monitoring network. We used quantitative measures of damage to trees and soils to infer burn severity and also rated damage to various forest strata using a modified version of the Composite Burn Index.

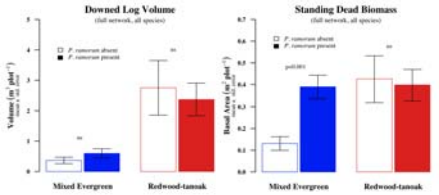
Results

Fuel Loads

Woody fuels of host species that suffer lethal infection are significantly higher in pathogen-impacted plots than in areas where the pathogen is absent.



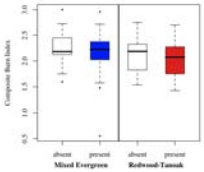
However, overall fuel loads summed across all species do not necessarily differ with pathogen presence or absence:



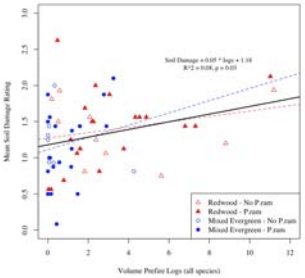
Results - continued

Burn Severity

Overall ratings of burn severity do not differ between infected and uninfected areas or between forest types.



However, variation in log abundance across plots predicts some of the variation in soil damage, which includes litter and duff consumption, deposited ash depth, and destruction of soil structure, among other metrics.



Conclusions

- The 2008 Big Sur wildfires presented a unique opportunity to assess feedbacks between changes to forest structure caused by SOD mortality and fire dynamics across the landscape.
- Levels of dead woody fuels from lethal host species are much higher in infected areas than in uninfected areas, but these differences do not always cause similar variation in overall fuel loads.
- At the local scale of our monitoring plots, burn severity is not closely tied to the abundance of standing dead trees or large ground fuels.
- We do not yet know, however, the ways in which local fuel loads affected fire spread or behavior at larger scales.
- The interactions between *Phytophthora ramorum* and large wildfires, such as the Basin Fire, are likely to be complex and occur at landscape scales.

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