Resilience of Diversity-Disease Risk Interactions following Wildfire Disturbance[1]

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Abstract

The potential for biodiversity to mitigate risk of infectious diseases in ecological communities – known as the diversity-disease risk hypothesis – is fundamental to understanding links between landscape change and environmental health of forests affected by sudden oak death (SOD). Previous research of the *Phytophthora ramorum* pathosystem found evidence for a dilution effect, where areas of high woody plant diversity were found to have significantly lower disease prevalence. However, little is known regarding the resilience of biodiversity effects subject to ecological disturbances. We investigate how this relationship changes following the dramatic restructuring of biodiversity by wildfire.

Previous work on this topic was centered in Big Sur, California, an ecoregion prone to complex disturbance interactions. In 2008, shortly after this study was conducted, the Basin Complex and Chalk fires burned nearly half of our disease monitoring plots, creating a natural biodiversity manipulation experiment. Using pre- and post-fire data collected over a period from 2006-2014, we compare how the diversity-disease relationship changes through time in disturbed and undisturbed plots. As a landscape epidemiology approach, we also account for the potentially confounding effects of host density and landscape heterogeneity by including variables for bay laurel (*Umbellularia californica*) density, tanoak (*Notholithocarpus densiflorus*) density, potential solar insolation, precipitation during the wet season, surrounding forest cover, and forest type (mixed-evergreen or redwood-tanoak).

We examine the diversity-disease risk relationship using three hierarchical models of varying complexity: (1) a binomial generalized linear model (GLM), (2) a zero-inflated binomial GLM, and (3) a zero-inflated binomial generalized linear mixed model (GLMM) with a spatial random effect. Our results indicate that the dilution effect was retained in both burned and unburned plots, suggesting that biodiversity effects are resilient to wildfire disturbances. These results provide valuable insights on how SOD and wildfire disturbance interact to affect landscape health, an ever more pressing need as SOD spread and natural disturbance regimes continue to be altered by anthropogenic change.

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