

Developing a Disease Resistance Research Program for Tanoaks

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Abstract

The introduced pathogen *Phytophthora ramorum* has had a devastating impact on populations of tanoak (*Notholithocarpus densiflorus* (Hook. & Arn.) Manos, Cannon & S.H. Oh) in California and Oregon, where it causes the disease known as sudden oak death. Tanoaks are a keystone species ecologically, and one of the few species that are both killed by *P. ramorum* and contributes to its spread. While ecologically important, tanoaks were little studied prior to the onset of the sudden oak death epidemic, resulting in few intellectual or material resources on which to base a disease resistance research program.

We report on progress to date on a project funded since 2006 by the U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, with the goal to collect the information required to understand what role resistance might play in the disease dynamics and/or management of tanoak populations. A common garden population of open-pollinated tanoak seed families has been established. These trees have been evaluated for variation in neutral genetic markers, growth and morphology, and quantitative resistance to laboratory inoculations. Simultaneously, a field disease trial, using the same families of trees, was initiated to validate and expand on laboratory observations, under natural disease pressures.

The work thus far has resulted in a significant expansion of the understanding of tanoak phylogeography and population genetics, the discovery of heritable quantitative resistance to disease in the lab, and potential links between morphology and disease resistance in the lab and field. Here, we tie together the investigations, presenting 3 years of data from laboratory and field resistance trials, along with their correlations with growth traits, in light of the understanding of tanoak population dynamics generated from neutral markers. We show the relevance of laboratory studies to field outcomes, and discuss the potential for disease resistance in driving the management or evolution of the species in response to this considerable threat.

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