

## **Incidence of *Phytophthora ramorum*, *P. nemorosa* and *P. pseudosyringae* in Three Coastal California Forest Communities**

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*Phytophthora ramorum* (Pr) is well established over approximately 450 km of forests along the California coast. In the course of research on this emerging pathogen, two other aerial *Phytophthoras*, *P. nemorosa* (Pn) and *P. pseudosyringae* (Pps), were discovered. Little is known about the ecology and biology of these other species and how they interact with Pr. Preliminary research has found that Pn and Pps have similar host ranges and cause similar disease symptoms as Pr, however do not appear to cause landscape level mortality of oaks (*Quercus* spp) and tanoak (*Lithocarpus densiflorus*) as does Pr. A plot study was established to determine the distribution and incidence of Pr, Pn and Pps in coastal forest communities, and relate pathogen presence to community, structural, and environmental variables. 120 circular 500 m<sup>2</sup> plots were set up at ten sites within the known range of Pr in Alameda, Contra Costa, Marin, Mendocino, Napa, Santa Cruz, and Sonoma counties. Field plots were established during the summer months of 2001 and 2002 and re-sampled in the spring and summer of 2004. Six of the sites were in California state parks, three were in county or regional parks, and one was on a private property protected with a conservation easement. Three types of native forest communities were surveyed: coast redwood, and two associations of the mixed evergreen forest, oak-bay-madrone and tanoak-madrone-live oak-Douglas-fir forests. Plots were located along elevational gradients proceeding perpendicularly from river valleys toward ridge tops, with three plots along four transects at each site. Plot selection was based on aspect, plant community, and minimized human disturbance, rather than presence of *Phytophthora* species. Each plot was evaluated for plant species composition, forest structure and environmental variables, and incidence of aerial *Phytophthora* species.

Results from 2001 and 2002 sampling confirmed Pr at four of ten sites and within 13% of plots. In 2004, Pr recovery increased to 29% of plots at seven sites. Pn was originally recovered in 7% of plots at two sites, with increasing recovery of 9% of plots at four sites in 2004. Pps was isolated in 6% of plots at two sites in the original sampling but increased to 9% of plots at three sites in 2004. In 2001 and 2002 sampling, the only coexistence of these *Phytophthora* species was when Pr and Pn were both isolated on two plots at one site. In 2004, Pr and Pn were found together at three sites and were both isolated from the same bay laurel tree (*Umbellularia californica*) 16 times and coast redwood (*Sequoia sempervirens*) one time. Pr coexisted with Pps at two sites with one co-occurrence on a bay laurel tree. Pn and Pps were not recovered together on any plots. All three *Phytophthora* species were detected at one site.

We found these three *Phytophthora* species to occupy similar ecological niches within the same plant communities. As with previous studies on Pr, bay laurel was a significant correlate with the occurrence of all *Phytophthora* species. Results from this study provide additional information about the distribution of Pr, including examination of location and intensity of SOD within state and regional parks, and within east bay counties where Pr plots had not previously been established. This is the first study to examine the ecological associations between these three *Phytophthora* species, across a wide geographic distribution and within several plant communities.