

The Role of Humans in the Dispersal and Spread of *Phytophthora ramorum*

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Determining how *Phytophthora ramorum* is dispersed across the landscape is critical for understanding the ecology and epidemiology of this influential pathogen. To date, researchers have shown that abiotic factors – such as rain-splash, wind-blown rain and down-stream transport of inoculum – are important in the dispersal of this pathogen. In contrast, very little research has focused on the potential for human dispersal of *P. ramorum*, although work on *P. lateralis* suggests that humans can play an influential role in disease spread for Port Orford cedar. Here, we summarize results from a study conducted in Sonoma County that addresses two research questions: 1) Do humans disperse *P. ramorum* along hiking trails in natural landscapes? and 2) Do areas visited intensively by humans have a greater proportion of foliar and terminal hosts showing symptoms of infection than areas visited less frequently?

To address the ability of humans to disperse *P. ramorum* throughout natural landscapes, we conducted a study during the spring of 2003 within different habitat types at Sonoma State University's Fairfield Osborn Preserve in eastern Sonoma County. We assessed soil samples for the presence or absence of *P. ramorum* on the trail surface and at adjacent locations 2 meters off trail in three habitat types that we hypothesized differed greatly in the amount of pathogen inoculum present in the soil: woodlands dominated by infected bay (*Umbellularia californica*) and coast live oak (*Quercus agrifolia*), open grassland lacking any foliar or terminal hosts, and stands of white oak (*Quercus garryana*; a non-hosts species). As expected, we found that *P. ramorum* was equally common in soil on and off trail from infected bay/coast live oak woodlands. However, for grasslands and white oak woodlands – habitats that lack *P. ramorum* hosts – the pathogen was commonly found in soil samples collected on trail, while being virtually absent off trail. These data suggest that hikers are important dispersal agents of *P. ramorum* and are able to transport the pathogen into areas that lack a local source of inoculum.

To determine whether symptom levels are greater in areas with high human activity, we used 202 plots in eastern Sonoma County, approximately half of which occurred in areas experiencing high visitation rates by humans, whereas the other half occurred in areas that had low visitation rates. During the spring and early summer of 2004, we sampled all foliar and terminal hosts in these plots for symptoms of infection by *P. ramorum*. After taking into account the influence of elevation, precipitation, solar radiation and topography, we found that, the proportion of symptomatic bay trees was significantly greater in plots experiencing high levels of human activity than those with low activity levels. In contrast, we did not find a significant relationship for terminal hosts. Collectively, our data suggest that high levels of recreational activity are associated with – and may lead to – increased levels of disease symptoms in bays, a foliar host that is thought to play a key role in the spread of Sudden Oak Death.