



CALIFORNIA OAK MORTALITY TASK FORCE REPORT TO THE BOARD OF FORESTRY OCTOBER 2015

MONITORING

2015 Sudden Oak Death (SOD) Blitz survey results found coastal mountain infestation levels in areas such as Big Sur, the Santa Cruz Mountains, and western Sonoma County remain high despite an overall decline in infection rates from 4.4 to 3.7% across California's 15 infested counties. Several new SOD outbreaks of note were identified. Two infected California bay laurel trees were confirmed near UC Berkeley's West Gate, a high-traffic, high-risk area with many heritage oaks. An infected California lilac shrub was found in the Presidio in San Francisco (part of the Golden Gate National Recreation Area). An infected California bay laurel tree was confirmed in Danville (Contra Costa County) in an area where SOD had not previously been reported, and an urban park in Saratoga was found infested for the first time.

Nineteen SOD Blitzes (the largest number of blitzes to date) were held this spring, two of which covered new geographic areas this year – one in Trinity County and one on Kashia Band of Pomo Indian land in Sonoma County. The 504 volunteers surveyed nearly 10,000 trees from San Luis Obispo County, north to Mendocino and Trinity Counties. The surveys were made possible by funding from the USDA Forest Service and the PG&E Foundation as well as help from the California Native Plant Society and local cooperators.

Local meetings to discuss results from the spring Blitzes as well as new SOD management recommendations will be held November 3rd (Sebastopol), November 4th (Berkeley), and November 13th (San Rafael). See the Calendar of Events below for more information. Previous year's results and more information on the SOD Blitz program may be found at www.sodblitz.org.

Northern Olympic Peninsula, WA community-based *Phytophthora ramorum* stream monitoring - In 2013, two *P. ramorum*-positive water bait samples were collected from the Dungeness River near Sequim, WA (Clallam County). Further sampling in 2014 did not yield information about the source of inoculum. The site where the positive samples were found had no apparent direct water connection with a *P. ramorum*-positive nursery and the source of inoculum was unknown. In spring 2015, Washington State University volunteers did intensive sampling of the river; no *P. ramorum* was found. These results suggest that *P. ramorum* may no longer be present in the watershed. For more information, go to <http://ppo.puyallup.wsu.edu/sod/monitoring/streams/2015monitoring/>.

RESEARCH

Haas, S.E.; Cushman, J.H.; Dillon, W.W.; Rank, N.E.; Rizzo, D.M.; and Meentemeyer, R.K. *In press*. Effects of Individual, Community and Landscape Drivers on the Dynamics of a Wildland Forest Epidemic. *Ecology*. <http://dx.doi.org/10.1890/15-0767.1>.



The challenges posed by observing host-pathogen-environment interactions across large geographic extents and over meaningful time scales limit our ability to understand and manage wildland epidemics. We conducted a landscape-scale, longitudinal study designed to analyze the dynamics of sudden oak death (an emerging forest disease caused by *Phytophthora ramorum*) across hierarchical levels of ecological interactions, from individual hosts up to the community and across the broader landscape. From 2004-11, we annually assessed disease status of 732 coast live oak, 271 black oak and 122 canyon live oak trees in 202 plots across a 275 km² landscape in central California. The number of infected oak stems steadily increased during the eight-year study period. A survival analysis modeling framework was used to examine which level of ecological heterogeneity best predicted infection risk of susceptible oak species, considering variability at the level of individuals (species identity, stem size), the community (host density, inoculum load, and species richness), and the landscape (seasonal climate variability, habitat connectivity, and topographic gradients). After accounting for unobserved risk shared among oaks in the same plot, survival models that incorporated heterogeneity across all three levels better predicted oak infection than did models focusing on only one level. We show that larger individuals of oaks (especially coast live oak) were more susceptible, and that interannual variability in inoculum production by the highly-infectious reservoir host, California bay laurel, had a stronger influence on disease risk than simply the density of this important host. Concurrently, warmer and wetter rainy-season conditions in consecutive years intensified infection risk, presumably by creating a longer period of inoculum build-up and increased probability of pathogen spillover from bay laurel to oaks. Despite the presence of many alternate host species, we found evidence of pathogen dilution, where less competent hosts in species-rich communities reduce pathogen transmission and overall risk of infection to oaks. These results identify key parameters driving the dynamics of emerging infectious disease in California woodlands, while demonstrating how multiple levels of ecological heterogeneity jointly determine epidemic trajectories in wildland settings.

Johnston, S.F.; Cohen, M.F.; Torok, T.; Meentemeyer, R.; and Rank, N. *In press.* Host Phenology and Leaf Effects on Susceptibility of California Bay Laurel to *Phytophthora ramorum*. *Phytopathology*. <http://dx.doi.org/10.1094/PHTO-01-15-0016-R>.

Abstract: Spread of the plant pathogen *Phytophthora ramorum*, causal agent of the forest disease sudden oak death, is driven by a few competent hosts that support spore production from foliar lesions. The relationship between traits of a principal foliar host, California bay laurel (*Umbellularia californica*) and susceptibility to *P. ramorum* infection were investigated with multiple *P. ramorum* isolates and leaves collected from multiple trees in leaf-droplet assays. We examined whether susceptibility varies with season, leaf age, or inoculum position. Bay laurel susceptibility was highest during spring and summer and lowest in winter. Older leaves (>1 year) were more susceptible than younger ones (8-11 months). Susceptibility was greater at leaf tips and edges than the middle of the leaf. Leaf surfaces wiped with 70% ethanol were more susceptible to *P. ramorum* infection than untreated leaf surfaces. Our results indicate that seasonal changes



in susceptibility of *U. californica* significantly influence *P. ramorum* infection levels. Thus, in addition to environmental variables such as temperature and moisture, variability in host plant susceptibility contributes to disease establishment of *P. ramorum*.

Knaus, B.J.; Fieland, V.J.; Graham, K.A.; and Grünwald, N.J. 2015. Diversity of Foliar *Phytophthora* Species on *Rhododendron* in Oregon Nurseries. Plant Disease. 99(10): 1326-1332. DOI: <http://dx.doi.org/10.1094/PDIS-09-14-0964-RE>.

Abstract: The genus *Phytophthora* contains some of the most notorious plant pathogens affecting nursery crops. Given the recent emergence of the sudden oak death pathogen *Phytophthora ramorum*, particularly in association with *Rhododendron* spp., characterization of *Phytophthora* communities associated with this host in nursery environments is prudent. Many taxa may present symptoms similar to *P. ramorum* but we do not necessarily know their identity, frequency, and importance. Here, we present a survey of *Phytophthora* taxa observed from seven nurseries in the U.S. state of Oregon. Incidence and diversity of *Phytophthora* communities differed significantly among nurseries and among seasons within nursery. The taxa *P. syringae* and *P. plurivora* were widespread and detected at most of the nurseries sampled. Nine other taxa were also detected but were found either in a single nursery or were shared among only a few nurseries. Characterization of the *Phytophthora* communities present in nurseries is an important step toward understanding the ecology of these organisms as well as an aid to nursery managers in determining what risks may be present when symptomatic plants are observed. This study builds on an increasing literature, which characterizes *Phytophthora* community structure in nurseries.

de la Mata Saez, L.; McCracken, A.R.; Cooke, L.R.; O'Neill, P.; Grant, M.; and Studholme, D.J. 2015. Draft Genome Sequences of Seven Isolates of *Phytophthora ramorum* EU2 from Northern Ireland. Genomics Data. Data in Brief. Vol. 6. Pages 191-192. DOI: [10.1016/j.gdata.2015.09.009](https://doi.org/10.1016/j.gdata.2015.09.009).

Abstract: Here we present draft-quality genome sequence assemblies for the oomycete *Phytophthora ramorum* genetic lineage EU2. We sequenced genomes of seven isolates collected in Northern Ireland between 2010 and 2012. Multiple genome sequences from *P. ramorum* EU2 will be valuable for identifying genetic variation within the clonal lineage that can be useful for tracking its spread.

Sambles, C.; Schlenzig, A.; O'Neill, P.; Grant, M.; and Studholme, D.J. 2015. Draft Genome Sequences of *Phytophthora kernoviae* and *Phytophthora ramorum* Lineage EU2 from Scotland. Genomics Data. Data in Brief. Vol. 6. Pages 193–194. DOI: [10.1016/j.gdata.2015.09.010](https://doi.org/10.1016/j.gdata.2015.09.010).

Abstract: Newly discovered *Phytophthora* species include invasive pathogens that threaten trees and shrubs. We present draft genome assemblies for three isolates of *Phytophthora kernoviae* and one isolate of the EU2 lineage of *Phytophthora ramorum*, collected from outbreak sites in Scotland.



Tooley, P.W.; Browning, M.; and Shishkoff, N. *In press*. *Pyracantha* ‘Mohave’ Fruit Infection by *Phytophthora ramorum* and transmission of the Pathogen from Infected Fruit to Roots of *Viburnum tinus*. Plant Disease. <http://dx.doi.org/10.1094/PDIS-03-15-0369-RE>.

Abstract: Colonization of the fleshy fruit of *Cornus florida*, *Cornus kousa*, *Laurus nobilis*, *Malus hupehensis*, and *Pyracantha* ‘Mohave’ was observed following inoculation with sporangia of *P. ramorum*. However, abundant production of chlamydospores was only observed in the fruit of *Pyracantha* ‘Mohave’. *Pyracantha* ‘Mohave’ fruits that had been inoculated with a *P. ramorum* sporangia suspension were placed in pots containing rooted cuttings of *Viburnum tinus* in a misting tent or in water-filled trays in a climate-controlled greenhouse. Runoff was collected for 24-30 days, and roots were plated after the final collection. Mean percent recovery from infected roots was not significantly different ($P = 0.05$, Tukey’s test) between bottom-watered treatments in trays and misted treatments, averaging 58% for bottom-watered and 54% for mist treatments. The number of colony-forming units (CFUs) collected in runoff from bottom-watered plants was consistently lower than that obtained from plants held under mist, likely due to desiccation of the fruit. The results show that root infection of *V. tinus* can occur by *P. ramorum* via infected fruit of *Pyracantha* ‘Mohave’. This phenomenon represents a pathway of infection for *P. ramorum* not previously reported, which may play a role in disease epidemiology.

RELATED RESEARCH

Copes, W.E.; Yang, X. and Hong, C. 2015. *Phytophthora* Species Recovered from Irrigation Reservoirs in Mississippi and Alabama Nurseries and Pathogenicity of Three New Species. Plant Disease. 99(10): 1390-1395.

Migliorini, D.; Ghelardini, L.; Tondini, E.; Luchi, N.; and Santini, A. 2015. The Potential of Symptomless Potted Plants for Carrying Invasive Soilborne Plant Pathogens. Diversity and Distributions. 21(10): 1218–1229. DOI: 10.1111/ddi.12347. Available online at <http://onlinelibrary.wiley.com/doi/10.1111/ddi.12347/abstract>.

CALENDAR

10/21 - SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC

Berkeley Campus; 1:00 – 3:00 p.m.; Pre-registration is required. This class is free and will be held rain or shine. To register, or for questions, email kpalmieri@berkeley.edu, and provide your name, phone number, affiliation and license number (if applicable), and the name and date of the class.

10/27 - Urban Forest Insect and Disease Workshop for Santa Cruz and Monterey

Area Arborists: What’s wrong with that tree?; Felton Community Hall, 6191 Highway 9, Felton; 10:00 a.m. - 3:30 p.m.; To register, or for more information, go to <http://caforestpestcouncil.org/2015/09/urban-forest-insect-and-disease-workshop-for-santa-cruz-and-monterey-area-arborists-whats-wrong-with-that-tree-october-27th-from-10am-330pm/> or contact Katie Harrell (previously Palmieri) at kpalmieri@berkeley.edu.



- 11/4 – 11/5 - 2015 Annual Meeting of the California Forest Pest Council; USDA**
Forest Service, Wildland Fire Training & Conference Center, Hamm and Loop rooms; 3237 Peacekeeper Way; McClellan; To register, or for more information, go to <http://caforestpestcouncil.org/2015/08/save-the-date-california-forest-pest-council-annual-meeting-november-4-5th-2015/> or contact Katie Harrell (previously Palmieri) at kpalmieri@berkeley.edu.
- 11/3 - Sudden Oak Death and Oak Drought Management Workshop; Sebastopol**
Center for the Arts (Veterans' Hall); 282 S. High St.; Sebastopol; 6:00 – 8:00 p.m.; This workshop is free. Registration is not required. For more information, go to <http://nature.berkeley.edu/garbelottowp/> or contact Katie Harrell at kpalmieri@berkeley.edu.
- 11/4 - Sudden Oak Death and Oak Drought Management Workshop; UC Berkeley;**
159 Mulford Hall; Berkeley; 6:00 – 8:00 p.m.; This workshop is free. Registration is not required. For more information, go to <http://nature.berkeley.edu/garbelottowp/> or contact Katie Harrell at kpalmieri@berkeley.edu.
- 11/13 - Sudden Oak Death and Oak Drought Management Workshop; Dominican**
University of California; Science Center Room #102; 155 Palm Avenue; San Rafael; 6:30 – 8:30 p.m.; This workshop is free. Registration is not required. For more information, go to <http://nature.berkeley.edu/garbelottowp/> or contact Katie Harrell at kpalmieri@berkeley.edu.
- 6/21 – 23/16 Sudden Oak Death Science Symposium 6; Fort Mason, San Francisco;**
Save the Date! More information will be available soon at <http://www.suddenoakdeath.org/>. For questions, contact Katie Harrell at kpalmieri@berkeley.edu or (510) 847-5482.