# CALIFORNIA OAK MORTALITY TASK FORCE REPORT
# AUGUST 2025

## MONITORING AND MANAGEMENT

**Del Norte County SOD monitoring update**. Surveys undertaken in early 2025 documented the spread of sudden oak death at the perimeters of known infestations in California's northwesternmost county. Most new knowledge came from stream surveys, coordinated by UC Cooperative Extension and the UC Davis Rizzo Lab, and the SOD Blitz surveying effort, coordinated by the UC Berkeley Forest Pathology and Mycology Lab with UC Cooperative Extension. The 2025 surveys observed an extension in the geographic range of *Phytophthora ramorum* within the county while also working to provide more information about the pathogen strains present there.

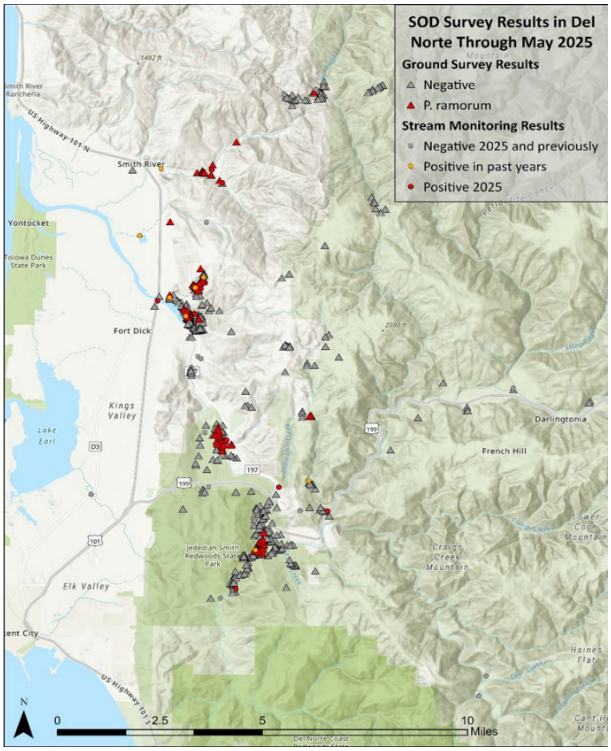
The stream survey effort encompassed 14 sites in Del Norte County; most were surveyed in previous years, but one new site was located on the main stem Smith River, which had not been sampled in several years. Previously positive creeks that were positive for the pathogen in 2025 included Peacock Creek, Myrtle Creek, Mill Creek, and Rowdy Creek. It was also detected in Rock Creek, near the southeastern end of State Route 197 close to Highway 199, where it had not previously been found. Additionally, *P. ramorum* was detected in the main stem Smith River, where it was detected previously in 2011 at a different baiting location along the river. This Smith River detection was confirmed as the NA2 strain of *P. ramorum.*

The SOD Blitz survey effort involved 12 personnel from seven organizations and turned up new terrestrial infestations in the middle Myrtle Creek watershed (near the boundary of the Smith River National Recreation Area / Six Rivers National Forest) as well as in the Morrison Creek watershed (a previous stream positive where the terrestrial source was not known) and in the Savoy Creek/South Fork Rowdy Creek watershed. A relatively large-scale (~5-15 acre) infestation was delineated on private property along Rowdy Creek Road. Additionally, the pathogen's presence was much more comprehensively and extensively delineated in the neighborhood surrounding Peacock Creek and See-tr'ee-ghin-dvm-dvn, an important cultural and botanical site. An extensive infestation stretching far upstream along Peacock Creek on private property suggested a longer residence time for *P. ramorum* in the local area than previously suspected, and residential outplanting there may have been a source for the EU1 and NA2 strains of the pathogen that have been detected. Although most of the positive samples were from tanoak sprouts and branches, positives also came from the foliage of bay laurel, coast redwood, and Pacific rhododendron.

Cooperators in these efforts included UC Cooperative Extension, the Rizzo and Garbelotto Labs at UC Davis and UC Berkeley, USDA Forest Service Region 5 and Six Rivers National Forest, Cal Fire, the Tolowa Dee-ni' Nation, the Del Norte County Agriculture Department, Green Diamond Resource Company, California State Parks, and numerous private landowners. As part of monitoring efforts for this pathogen in 2025 and in previous years, several other non-native *Phytophthora* species have been detected in the public lands and private neighborhoods surrounding Jedediah Smith State Park, including *P. cinnamomi, P. cambivora,* and *P. lateralis,*

as have other oomycete species with uncertain pathogenicity. This underscores the challenges inherent to tracking and managing these non-native pathogens that have landed and are apparently flourishing in an environment where the climate and soils are ideal for their development and spread. For more information, contact Wallis Robinson, wlrobinson@ucanr.edu, or Chris Lee, christopher.lee@fire.ca.gov.

Coast redwood infected by *P. ramorum* in Rowdy Creek watershed, Del Norte County. Photo: Chris Lee, Cal Fire.




Current known extent of *P. ramorum* in Del Norte County. Figure: Wallis Robinson, UC Cooperative Extension, Humboldt and Del Norte Counties.

**Integrated disease and fuels treatments in redwood forests: new experiments at the Soquel Demonstration State Forest.** Angela Bernheisel and Colin Noyes from Cal Fire, along with, Richard Cobb (Cal Poly San Luis Obispo), expanded an ongoing integrated fuels and disease mitigation experiment to the Soquel Demonstration State Forest (SDSF). Located near Santa Cruz, the SDSF is one of the earlier locations to experience disease outbreak and has been the location of several important studies of basic *Phytophthora ramorum* biology, genetics, and epidemiology. Unlike many disease-impacted forests just south (Big Sur) and north (San Francisco Peninsula region), the SDSF operates an active timber harvest and forest health treatment program. The forest and its collaborators competed for two Cal Fire Forest Health grants in 2021, successfully acquiring separate funding for a series of forest health treatments and to evaluate treatment impacts to sudden oak death and forest structure. Treatments and initial treatment evaluation were completed in 2024.

The SDSF study builds on treatments in the Marin Municipal Water District (MMWD) and the Lacks Creek BLM property in Humboldt County initiated in 2012 & 2013. While the MMWD treatments also occurred in an area where the disease first emerged, the SDSF has been actively managed for timber up to and after emergence of the disease. The Lacks Creek experiments are pre-disease treatments (preventive). Each treatment site includes mastication and hand-crew pile-treatments (with and without burning). The SDSF treatments also include broadcast prescribed fire and commercial redwood thinning. The SDSF treatments are timed such that all three sites can be measured on 5-year intervals, with the MMWD and Lack's Creek sites also surveyed in 2023 to provide 10-year post treatment evaluation. As a whole, these three experiments point strongly to the value of treatment legacies. Dense basal sprouting and regeneration following disease emergence is costly to treat initially and require maintenance every 2-3 years to retain treatment benefits. Treatments at the SDSF provide a valuable contrast to the other sites: while commercial thinning is expected to increase canopy opening, the silvicultural legacy generally appears to limit understory densities, suggesting that treatment benefits will require fewer resources to maintain. For more information, contact Richard Cobb, rccobb@calpoly.edu, or Colin Noyes, colin.noyes@fire.ca.gov.

## NURSERIES AND MANAGED LANDSCAPES

**California Department of Agriculture *P. ramorum* Nursery Program Update.** Eight Positive Nurseries in 2025: Seven California nurseries that were previously positive for *Phytophthora ramorum* (*P. ramorum*) underwent enhanced inspections in March and April. Three of the previously positive nurseries were again found positive for *P. ramorum* in 2025. The additional five positive nurseries this year were found to be positive through trace and annual compliance inspections and are undergoing the USDA's Interstate and Retail Protocols for Nurseries Confirmed Positive for *Phytophthora ramorum* from the *Phytophthora ramorum* Domestic Regulatory Program Manual. Trace inspections have yielded positive plants at one production nursery in a non-quarantined county and one retail nursery in a quarantined county. Plants confirmed positive for *P. ramorum* in 2025 in California nurseries are: *Arctostaphylos* sp. (1); *Camellia* sp. (8) Varieties: Pearl Maxwell, Debutante Light Pink, Yuletide, Chansonette; *Loropetalum chinense* (3) Varieties: 'Razzleberry', rubrum; *Magnolia grandiflora* (1);

*Pieris japonica* (2); *Rhododendron* sp. (8) Varieties: Roseum Elegans, Catawbiense; *Viburnum* sp. (3). For more information, contact Carolyn Lambert, Carolyn.Lambert@cdfa.ca.gov.

**Oregon Department of Agriculture *P. ramorum* Nursery Program Update.** Currently, there are twelve nurseries participating in Oregon's *P. ramorum* Nursery Program. Eight nurseries are interstate shippers under federal compliance agreements (7 CFR 301.92). They are in Washington (3), Clackamas (2), and Marion (2) and Lane (1) counties. Five nurseries are intrastate shippers operating under state compliance agreements (both 7 CFR 301.92 and OAR 603-052-1230) in Clackamas (2), Lane (2) and Curry (1) Counties.

Five Spring Compliance surveys were conducted in March and April, and one nursery successfully exited the program thereafter. Three of the spring surveys found *P. ramorum* onsite and two have finished the following delimitations. Four large production nurseries were added to the program this spring in Lane (1), Marion (1), Clackamas (1) and Washington (1) counties. Three new retail nurseries were also found to be positive for *P. ramorum* and have been added to the intrastate program in Lane (2) and Curry (1) Counties. There have been many tracebacks this spring which has resulted in adding these additional nurseries. To be released from the program, nurseries must achieve six consecutive negative results from compliance inspections over three years. One nursery was released from the program after the Fall survey. Two nurseries are eligible to be released after the Spring survey if results are negative.

For more information, please contact Kevin Bailey, kevin.f.bailey@oda.oregon.gov, or Kara Mills, kara.mills@oda.oregon.gov.

**Washington State Department of Agriculture (WSDA) *P. ramorum* Program Update.** WSDA received notice of four trace forwards from out of state nurseries. Investigations followed and positive plants were found during two of the four trace forwards. Both positive finds were at retail nurseries. WSDA is assisting in moving the nurseries through the USDA protocols. Haley Palec is the WSDA Plant Services Program Supervisor for Western Washington and is based in Tacoma. For more information contact Haley Palec, hpalec@agr.wa.gov.

## RESEARCH

**Cauldron, N.C., Daniels, H.A., LeBoldus, J.M., and Grünwald, N.J. 2025.** Population Genomic Analysis of Two Independent Clonal Invasions of the Sudden Oak Death Pathogen into One Forest. Phytopathology. Published Online: 28 May 2025. https://doi.org/10.1094/PHYTO-10-24-0329-FI.

**Abstract:** Upon introduction, clonal pathogen populations are expected to go through a genetic bottleneck followed by gradual clonal divergence. Two distinct and purely clonal lineages of the sudden oak death pathogen *Phytophthora ramorum* recently emerged in forests in the Western United States, providing the unique opportunity to study a naturally replicated invasion into the same ecosystem. We characterized population genomic patterns during early invasion using whole genome sequencing of two *P. ramorum* clonal lineages sampled in the first five years following their detection. We re-sequenced genomes from populations of two dominant clonal

lineages, NA1 (n=134; 2001-2005) and EU1 (n=160; 2015-2019), and obtained 106,070 high-quality SNPs in genic regions. Our results are consistent with the hypothesis of one introduction for each lineage. The NA1 population had a wider distribution of pairwise genetic distances than EU1 and higher genetic diversity, though neither NA1 nor EU1 populations clustered clearly by year. There was significant correlation between genetic distance and geographic distance for NA1 ($p = 0.042$), but not for EU1 ($p = 0.402$). The genetic diversity in NA1 is strongly driven by loss of heterozygous positions, which impacted more than one-third of the sampled NA1 population. However, loss of heterozygosity was rare in EU1. This work provides novel insights into the invasion biology and dynamics of clonal plant pathogens in natural ecosystems.

**Cauldron, N.C., Press, C.M. Weisberg, AJ., Jung, M.H., Corcobado, T., Webber, J.F., Kageyama, K., Heino, A., Masuya, H., Uematsu, S., Scanu, B., Brasier, C.M., Jung, T., Change, J.H. and Grünwald, N.J. 2025.** Intraspecific Variation and Recent Loss of Ancient, Conserved Effector Genes in the Sudden Oak Death Pathogen *Phytophthora ramorum*. Molecular Plant-Microbe Interactions 38:3, 440-453. https://doi.org/10.1094/MPMI-10-24-0131-R.

**Abstract:** Members of the *Phytophthora* genus are responsible for many important diseases in agricultural and natural ecosystems. *Phytophthora ramorum* causes devastating diseases of oak and tanoak stands in U.S. forests and larch in the United Kingdom. The four evolutionary lineages involved express different virulence phenotypes on plant hosts, and characterization of gene content is foundational to understanding the basis for these differences. Recent discovery of *P. ramorum* at its candidate center of origin in Asia provides a new opportunity for investigating the evolutionary history of the species. We assembled high-quality genome sequences of six *P. ramorum* isolates representing three lineages from Asia and three causing epidemics in Western U.S. forests. The six genomes were assembled into 13 putative chromosomes. Analysis of structural variation revealed multiple chromosome fusion and fission events. Analysis of putative virulence genes revealed variations in effector gene composition among the sequenced lineages. We further characterized their evolutionary history and inferred a contraction of crinkler-encoding genes in the subclade of *Phytophthora* containing *P. ramorum*. There were losses of multiple families and a near complete loss of paralogs in the largest core crinkler family in the ancestor of *P. ramorum* and sister species *P. lateralis*. Secreted glycoside hydrolase enzymes showed a similar degree of variation in abundance among genomes of *P. ramorum* lineages as that observed among several *Phytophthora* species. We found plasticity among genomes from multiple lineages in a *Phytophthora* species and provide insights into the evolutionary history of a class of anciently conserved effector genes.

**Peterson, E.K., Grünwald, N.J., and Parke, J.L. 2025.** Soil Temperature and Moisture Conditions Affect the Recovery and Sporulation Capacity of *Phytophthora ramorum* from Infested *Rhododendron* Leaf Disks. Phytopathology. Published Online: 28 May 2025. https://doi.org/10.1094/PHYTO-02-25-0056-R.

**Abstract:** The invasive pathogen *Phytophthora ramorum* persists within nurseries, potentially within buried, infested leaf debris. To determine how the environment – notably soil temperature and moisture levels – affects the epidemiological risk of soil inoculum reserves, we performed laboratory assays assessing how variable conditions impact pathogen survival and its capacity to

sporulate. We first established that incubating inoculum at 4°C increases the number of sporangia produced from infested rhododendron leaf disks. In a second experiment, inoculum was incubated in soil at a range of temperature (6.7, 14, 20, or 28°C) and soil moisture (approximating 0, -40, or -400 kPa) conditions for up to 18 weeks. Our ability to culture *P. ramorum* was only negatively affected by the warmest and driest regimes. In contrast, the capacity to sporulate was affected over a much wider range of conditions, whereby declines in sporulation potential were observed over time from inoculum incubated at both 20 and 28°C in all soil moisture conditions. However, subsequent incubation of this inoculum at 4°C for an additional seven weeks restored sporulation potential, at times exceeding pre-incubation levels. These results are consistent with field-observations that *P. ramorum* becomes more biologically active after exposure to cooler temperatures, and highlights the risk soilborne inoculum poses during some times of the year. Disinfestation of soils through artificially high heat is likely required to prevent recurrent infections within nurseries from soilborne sources, and thus prevent the further spread of this invasive pathogen. The invasive pathogen *Phytophthora ramorum* persists within nurseries, potentially within buried, infested leaf debris. To determine how the environment – notably soil temperature and moisture levels – affects the epidemiological risk of soil inoculum reserves, we performed laboratory assays assessing how variable conditions impact pathogen survival and its capacity to sporulate. We first established that incubating inoculum at 4°C increases the number of sporangia produced from infested rhododendron leaf disks. In a second experiment, inoculum was incubated in soil at a range of temperature (6.7, 14, 20, or 28°C) and soil moisture (approximating 0, -40, or -400 kPa) conditions for up to 18 weeks. Our ability to culture *P. ramorum* was only negatively affected by the warmest and driest regimes. In contrast, the capacity to sporulate was affected over a much wider range of conditions, whereby declines in sporulation potential were observed over time from inoculum incubated at both 20 and 28°C in all soil moisture conditions. However, subsequent incubation of this inoculum at 4°C for an additional seven weeks restored sporulation potential, at times exceeding pre-incubation levels. These results are consistent with field-observations that *P. ramorum* becomes more biologically active after exposure to cooler temperatures, and highlights the risk soilborne inoculum poses during some times of the year. Disinfestation of soils through artificially high heat is likely required to prevent recurrent infections within nurseries from soilborne sources, and thus prevent the further spread of this invasive pathogen.

## RELATED RESEARCH

**EFSA Panel on Plant Health (PLH). 2025.** Commodity risk assessment of *Berberis thunbergia* plants from the UK. EFSA Journal 23(6):e9496. doi: 10.2903/j.efsa.2025.9496.

**Abstract:** The European Commission requested the EFSA Panel on Plant Health to prepare and deliver risk assessments for commodities listed in Commission Implementing Regulation (EU) 2018/2019 as 'high risk plants, plant products and other objects'. Taking into account the available scientific information, including the technical information provided by the applicant country, this Scientific Opinion covers the plant health risks posed by the following commodities: *Berberis thunbergii*, bare root plants (up to 3 years old), whips (up to 2 years old) and rooted plants in pots (up to 4 years old) imported into the EU from the UK. A list of pests potentially associated with the commodities was compiled. The relevance of each pest was assessed based on evidence following defined criteria. One EU quarantine pest (*Phytophthora*

*ramorum* (non-EU isolates)), one protected zone quarantine pest (*Bemisia tabaci* (European populations)) and one non-quarantine pest (*Phytophthora kernoviae*) were selected for further evaluation. For the selected pests, the risk mitigation measures implemented in the UK and specified in the technical dossier were evaluated taking into account the factors reducing their efficacy. For these pests, an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on the pest, including uncertainties associated with the assessment. The degree of pest freedom varies between the pests evaluated, with *P. ramorum* being the pest most frequently expected on the evaluated imported commodities. Expert Knowledge Elicitation indicated, with 95% certainty, that between 9975 and 10,000 per 10,000 *B. thunbergii* rooted plants in pots would be free from *P. ramorum.*

**Bregant, C., Carloni, F., Borsetto, G., Delle Donne, A. G., Linaldeddu, B. T., and Murolo, S. 2025**. Multiple Botryosphaeriaceae and Phytophthora Species Involved in the Etiology of Holm Oak (Quercus ilex L.) Decline in Southern Italy. Forests, 16(7), 1052. https://doi.org/10.3390/f16071052.

**Abstract:** In recent years, severe decline and mortality events have been observed in holm oak (*Quercus ilex* L.) ecosystems in different Italian regions, including Puglia (southern Italy). Given the landscape and ecological relevance of holm oak forests in Apulia, a study was conducted to identify the causal agents related to this complex disease syndrome. The surveys, conducted in winter 2024 in three different woodlands, revealed the widespread occurrence of mature holm oak trees showing sudden death, crown thinning, shoot and branch dieback, sunken cankers, and root rot symptoms. Isolations performed from symptomatic samples collected from both stem and small roots yielded fungal and fungal-like colonies representing two distinct families: *Botryosphaeriaceae* and *Peronosporaceae*. Analysis of morphological and DNA sequence data allowed us to identify six distinct species, including *Diplodia corticola* and *D. quercivora* (*Botryosphaeriaceae*), *Phytophthora cinnamomi, P. multivora, P. psychrophila,* and *P. asparagi* (*Peronosporaceae*). For *P. asparagi* and *P. psychrophila*, isolated for the first time from declining holm oak trees in Italy, Koch's postulates were satisfied by inoculating 1-year-old seedlings at the collar in controlled conditions. Thirty days after inoculation, all plants showed the same symptoms observed in the field. Overall, the data obtained highlights the co-occurrence of multiple *Botryosphaeriaceae* and *Phytophthora* species on declining holm oak trees and the discovery of a new haplotype of *Diplodia quercivora*.