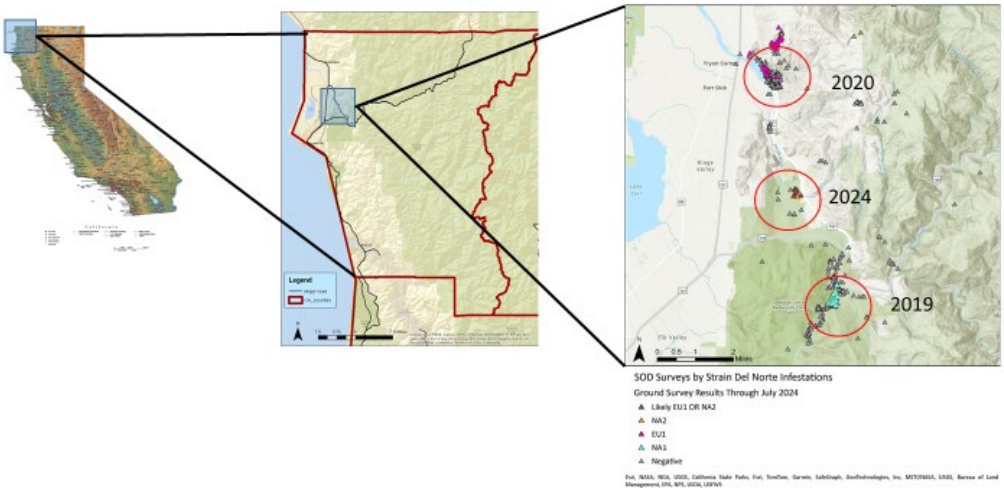
# CALIFORNIA OAK MORTALITY TASK FORCE REPORT
# NOVEMBER 2024

## MONITORING - CALIFORNIA

**In 2024, sudden-oak-death-caused mortality did not greatly increase in California** wildlands according to preliminary results from the U.S. Forest Service, Pacific Southwest Region, annual aerial survey of tree mortality. In the North Coast, tanoak (*Notholithocarpus densiflorus*) mortality, most likely caused by *Phytophthora ramorum*, was recorded on approximately 3,400 acres (1,376 ha) at very light to moderate intensities, mostly occurring in Mendocino County. In the Central Coast, tanoak mortality was detected across approximately 30 acres (12 ha) west of Alder Peak on the Monterey District, Los Padres National Forest. Mixed-oak mortality was detected across about 640 acres (259 ha), but the observed pattern indicates most of the mortality is not likely caused by *P. ramorum*. Mortality was widely scattered in the southern Bay Area and in the Los Padres NF. The cause of death for the oaks has not been identified. For more information contact Jeffrey Moore, jeffrey.moore@usda.gov.

However, significant new detections have been made in Del Norte County, where intensive terrestrial and stream survey efforts have taken place throughout 2024. The newest detections were in the lower part of the Peacock Creek drainage, between State Route 197 and the main stem Smith River. This is an area that is partly residential and partly owned by California State Parks. It is roughly halfway between previously detected infestations that belong to the NA1 lineage along Mill Creek to the south, and EU1 infestations along SR 197 to the north (Figure 1). Most concerning about the newest detections, which have come from both stream water and tanoak sprouts, is that they belong to both the EU1 and NA2 lineages. NA2 has not been detected in California forests before. For more information, contact Wallis Robinson, wlrobinson@ucanr.edu, or Chris Lee, christopher.lee@fire.ca.gov.

**Figure 1. Locations of known infestations in Del Norte County, with years of first detection. Bottom infestation is NA1 lineage; top infestation is EU1 lineage; middle infestation contains both EU1 and NA2 lineages. Map courtesy of Wallis Robinson, UC Cooperative Extension and Chris Lee, Cal Fire.**



## RESEARCH

**Plant community composition and forest structure changes in response to *P. ramorum* (sudden oak death, SOD) invasion and eradication: introduction to the Oregon SOD Permanent Plot Network.** E.K. Peterson, S. Chase, M. Tosa, and J.M. LeBoldus, Oregon State University

Over 20 years have passed since *P. ramorum* was first detected in Oregon. In response, the Oregon Department of Forestry and USDA Forest Service, with other Federal and private partners, mounted an eradication effort built on the early identification of new infection centers and rapid removal of the main overstory hosts. To date this has culminated in the removal of tanoak from over 3,500 ha of coastal forest. Despite some successes, *P. ramorum* continues to spread and treatments now focus on the leading edges of the epidemic. The invasion of forest pathogens, particularly those capable of removing dominant overstory species, can have cascading impacts on local biological communities as well as the region's ecosystem processes. These impacts likely differ depending upon the means by which trees are lost (i.e. SOD eradication vs. SOD mortality), which may have long-term ecological impacts.

To investigate the long-term effects of SOD, and notably SOD management, we established a monitoring plot network assessing forest and plant community structure within SOD-impacted areas. In total, 88 circular plots (each 500 $m^2$) were established, including 34 uninfested and untreated plots (untreated-negative), 35 plots in which *P. ramorum* was detected and eradication treatments were undertaken (treated; surveyed 3-15 years post-eradication), and 19 plots in which *P. ramorum* was detected and no eradication was performed (untreated-positive; surveyed 0-8 years since the first evidence of mortality). In each we performed a full forest inventory of all tree stems >1 cm diameter and tabulated total plant diversity and tree recruitment.


**Figure 2. Representative photos of different Oregon plot classifications: A. Untreated-negative, in which *P. ramorum* has not been detected; B. Untreated-positive, in which *P. ramorum* has been recovered but no eradication treatments have been performed; C and D. Plots where *P. ramorum***

**was detected and eradication protocols were performed. Treated plots are divided into those representing "early" recovery stages (surveyed 3-9 years post-treatment, C) and those representing "late" recovery stages (surveyed 10-15 years post-treatment, D). The majority of the vegetation in all photos is tanoak, *Notholithocarpus densiflorus*. Photos courtesy E. Peterson, OSU.**

Tanoak and Douglas-fir were widely distributed throughout the plot network. Basal areas for these two species in untreated-negative plots comprised an average of 42.6 and 35.8 $m^2$/ha, respectively; in comparison, average basal area for the next most widely distributed tree species, California bay laurel, comprised only 2.3 $m^2$/ha. As expected, tanoak rarely reached breast height within plots in early stages of treatment recovery (3-9 years post-eradication). Within treated plots, however, tanoak dominance was re-established roughly 10 years after eradication had taken place. This response was solely via sprouting, where stem densities were 3-4 times greater than that observed in any of the untreated plot classes. We observed increases in plot-level tanoak mortality 3-5 years after SOD-detection in untreated-positive plots, with some having as little as 20% of living tanoak stems remaining upon survey. However, the extent to which SOD eradication can serve as a proxy for SOD mortality remains unknown, particularly as these plots are in the early-stages of invasion. Vegetation and recruitment inventories indicate some similarities between treated and untreated-positive plots. For example, herbaceous species diversity was similar (elevated in comparison to untreated-negative plots), but we observed differences in tree recruitment.

The intent is to resurvey these plots over time to inform future management decisions meant to control invasive forest species. Further investigations are assessing how these forest changes are impacting soil microbiome community structure, invertebrate diversity, bird and mammal usage of the plots. Fortunately, re-infection of tanoak within eradicated plots remains uncommon. Ideally eradication has contributed towards the re-establishment of tanoak within Oregon coastal forests, although repeated introductions of *P. ramorum* and further spread of established populations are a continuous threat.

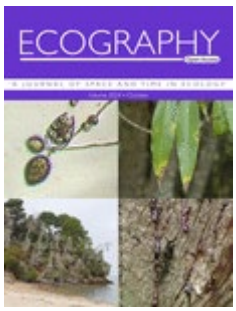
**Shamoun, S.F.; Elliott, M. 2024.** *Phytophthora ramorum* Werres, de Cock & Man in't Veld, Sudden Oak Death/Encre des chênes rouges (Peronosporaceae). Pgs 593-602 in Vankosky, M.A.; Martel, V. Biological Control Programmes in Canada, 2013-2023. CABI. doi.org/10.1079/9781800623279.0063.

*Phytophthora ramorum* is the causal agent of sudden oak death, a disease that has killed millions of oak and tanoak trees in California and Oregon in the United States and of sudden larch death in the United Kingdom. *Phytophthora ramorum* was first detected in Canada in 2003 in nurseries in the Greater Vancouver area of British Columbia. *Phytophthora ramorum* is regulated by the Canadian Food Inspection Agency; nurseries where the pathogen is detected are placed in quarantine and all host plants are destroyed, at significant cost. This chapter reviews the biology and impact of *P. ramorum* and its management using monitoring and prevention, chemical control, and biological control. Fungal antagonists of *P. ramorum* from the genus *Trichoderma* and bacterial antagonists from the genus *Bacillus* show promise as biological control agents, but will likely need to be used as part of an integrated pest management strategy that includes prevention via sanitation and disinfection.

**Mainello-Land, A.; Saville, A.C.; Acharya, J.; and Ristaino, J. 2024.** Loop-mediated isothermal amplification detection of *Phytophthora kernoviae*, *Phytophthora ramorum*, and the *P. ramorum* NA1 lineage on a microfluidic chip and smartphone platform. Phytopathology. https://doi.org/10.1094/PHYTO-02-24-0055-R.

Rapid, field-deployable assays such as loop-mediated isothermal amplification (LAMP) are critical for detecting nursery and forest pathogens like *Phytophthora ramorum* and *P. kernoviae* to prevent pathogen spread. We developed and validated four LAMP assays for genus-level detection of *Phytophthora* spp., species-level detection of *P. kernoviae* and *P. ramorum* and lineage-level detection of the *P. ramorum* NA1 lineage. Cross reactivity of the two species-specific LAMP assays was evaluated using a set of 18 *Phytophthora* spp. known to infect nursery crop hosts. The correct target species were detected by the species-level LAMP assays. The *Phytophthora* spp. LAMP assay was evaluated against 27 *Phytophthora* spp. and other bacterial and fungal pathogens and reacted with all the *Phytophthora* spp. evaluated but no other bacterial or fungal species. The limit of detection (LOD) of the *P. kernoviae* LAMP was 100 fg/µl and the LOD of the *P. ramorum* LAMP assay was 1 pg/µl of DNA. The NA1 LAMP assay was tested against the NA1, NA2, EU1, and EU2 lineages of *P. ramorum* and was lineage-specific but had a higher LOD (100pg/µl) than the species-specific LAMP assays. Both *P. ramorum* and *P. kernoviae* LAMP assays were highly precise (>0.94) in detecting the respective pathogens in symptomatic rhododendron leaves and co-inoculation experiments. The set of four LAMP assays were run in tandem on a microfluidic chip and smartphone platform and can be used in the field to detect and monitor spread of these regulatory *Phytophthora* spp. in forest and/or nursery settings.

**Sudden oak death/*P. ramorum* is featured on the cover of the Disease Ecology special issue of the journal Ecography.** The cover highlights **Kozanitas, M.; Knaus, B.J.; Tabima, J.F.; Grünwald, N.J.; Garbelotto, M. 2024.** Climatic variability, spatial heterogeneity and the presence of multiple hosts drive the population structure of the pathogen *Phytophthora ramorum* and the epidemiology of Sudden Oak Death. Ecography. Volume 2024(10): e07012. doi.org/10.1111/ecog.07012.




## RELATED RESEARCH

**Christen, S.; Brockerhoff, E.G.; Gossner, M.M.; Augustinus, B.A. 2024.** A biosecurity perspective on urban trees in public and private spaces and trees available from nurseries. Urban Forestry & Urban Greening. 101: 28529. doi.org/10.1016/j.ufug.2024.128529.

**EFSA Panel on Plant Health (PLH). Bragard, C.; Baptista, P.; Chatzivassiliou, E.; Di Serio, F.; Gonthier, P.; Jaques Miret, J.A.; Justesen, A.F.; MacLeod, A.; Magnusson, C.S.; Milonas, P. 2024.** Commodity risk assessment of *Sorbus aucuparia* plants from the UK. EFSA Journal. 22(6): e8837.

**Harkness, R.; Suslow, K.; Sharma, S.; Sakalidis, M.L.; Miles, T.; Schweigkofler, W. 2024 First Look.** Diversity and risk assessment of *Phytophthora* spp. found on plant roots in native plant nurseries and interstate shipping nurseries in California. PhytoFrontiers. doi.org/10.1094/PHYTOFR-06-24-0064-R.

**Hunter, S.; Waipara, N.; Burns, B.; Scott, P.; Williams, N. 2024.** Impacts of phosphite treatment on *Phytophthora* community assemblages and inoculum abundances in *Phytophthora*-infected forest soil. Trees, Forests and People. 18: 100687. doi.org/10.1016/j.tfp.2024.100687.

**LeBoldus, J.M.; Lynch, S.C.; Newhouse, A.E.; Søndreli, K.L.; Newcombe, G.; Bennett, P.I.; Muchero, W.; Chen, J-G.; Busby, P.E.; Gordon, M.; Liand, H. 2024.** Biotechnology and genomic approaches to mitigating disease impacts on forest health. Annual Review of Phytopathology. 62: 309-335. https://doi.org/10.1146/annurev-phyto-021622-114434.

**López-García, N. 2024.** Forest *Phytophthora*–Ecology, Diversity and Management. Acta Universitatis Agriculturae Sueciae. Swedish University of Agricultural Sciences. Doctoral thesis. Number 67. doi.org/10.54612/a.4p1n97bp4k.

**Martens, C.; Clark, S.; Schweitzer, C. 2024.** The international oak symposium: Science-based management for dynamic oak forests. General Technical Report SRS-278. U.S. Department of Agriculture, Forest Service, Southern Research Station. October 2024. https://doi.org/10.2737/SRS-GTR-278.

**Noseworthy, M.K.; Allen, E.A.; Dale, A.L.; Leal, I.; John, E.P.; Souque, T.J.; Tanney, J.B.; Uzunovic, A. 2024.** Evidence to support phytosanitary policies–the minimum effective heat treatment parameters for pathogens associated with forest products. Frontiers in Forests and Global Change. 7: 1380040. doi: 10.3389/ffgc.2024.1380040.

## NURSERIES AND MANAGED LANDSCAPES

**Oregon Department of Agriculture *P. ramorum* nursery program update.** There are currently seven nurseries participating in the Oregon *Phytophthora ramorum* Nursery Program. Five nurseries are interstate shippers under federal compliance agreements (7 CFR 301.92). They are in Washington (2), Columbia (1), and Marion (2) Counties. One nursery is an intrastate shipper operating under state compliance agreements (both 7 CFR 301.92 and OAR 603-052-1230) in Clackamas County. Another nursery located in Clackamas County was newly added in July 2024. The nursery was identified from a trace-back investigation and is currently going through the delimitation process.

Compliance inspections for the 2024 fall season began on September 30th. There were six nurseries which required a compliance inspection entering the sampling season. During the spring season, four nurseries were negative and two came back with positive samples. To be

released from the program, nurseries must achieve six consecutive negative results from compliance inspections over three years. No nurseries are eligible to be released from the program this fall. For more information, please contact Kevin Bailey (kevin.f.bailey@oda.oregon.gov) or Kara Mills (kara.mills@oda.oregon.gov).

**Washington Department of Agriculture (WSDA) *P. ramorum* program update.** WSDA received trace-forward information in August 2024 due to a *P. ramorum* finding at an out-of-state nursery. Four Washington nurseries received plants as part of this trace-forward. Most of the plants were shipped in February 2024, and many had already been sold. All four nursery locations were inspected, and one secondary inspection took place at another nursery. No symptoms were found, and no samples were taken. The out-of-state nursery reported three of the four positive varieties were purchased from a Washington nursery three years prior. WSDA inspected the Washington nursery as part of a trace-back investigation. No symptoms were found, and no samples were taken. For more information contact Haley Palec, hpalec@agr.wa.gov.

## EDUCATION, OUTREACH AND MONITORING

**The results of the 2024 Sudden Oak Death blitz will be presented at three events**, your choice of in-person or online. The free sessions will feature Dr. Matteo Garbelotto, UC Berkeley Forest Pathology and Mycology Laboratory discussing the distribution of 2024 *P. ramorum* and sudden oak death outbreaks. The dates available are: in-person, Thursday, November 12th, from 6-8 pm, Woodside Town Hall; online, Tuesday, November 19th, from 5-7 pm; and in-person, Wednesday, December 11th, from 6-8 pm at the UCCE Sonoma Office, in Santa Rosa. For more details and to register see the SOD Blitz website, www.sodblitz.org.

**Recordings from the 2024 virtual meetings of the California Oak Mortality Task Force** (COMTF) and the Phytophthoras in Native Habitats Work Group (CALPHYTOS) are now available at www.suddenoakdeath.org. The COMTF meeting focused on the status of sudden oak death/*P. ramorum* in California and Oregon wildlands – Recording and Agenda. Of note, first detections of the NA2 lineage of *P. ramorum* are discussed. The CALPHYTOS meeting theme, "Risks to California Native Plants" includes talks on viruses, excessive heat, and other concerns **– Recording, and Agenda**. For questions or to provide feedback, contact Janice Alexander, jalexander@ucanr.edu.