CALIFORNIA OAK MORTALITY TASK FORCE REPORT
OCTOBER 2021

MONITORING AND MANAGEMENT - OREGON

The Oregon Department of Forestry has begun sudden oak death (SOD, *Phytophthora ramorum*) treatment work on private lands within the core of the NA2 infested area in Port Orford. The treatment area has expanded to 521 acres, encompassing 146 positive tanoak and rhododendrons in the area. Thus far 104 acres have been flagged off for treatment, with 80 acres of tanoak treated with herbicide. Fifteen acres of tanoak have been cut and piled and are ready to burn once fire restrictions are lifted in the area.

The Oregon SOD Program recently released an updated version of the **Oregon SOD Dashboard** to share with the public information on survey, detection, and SOD treatment status in all areas under state quarantine. A real-time map, and monitoring and treatment statistics are displayed (Figure 1). For more information contact Sarah Navarro at Sarah.Navarro@usda.gov.

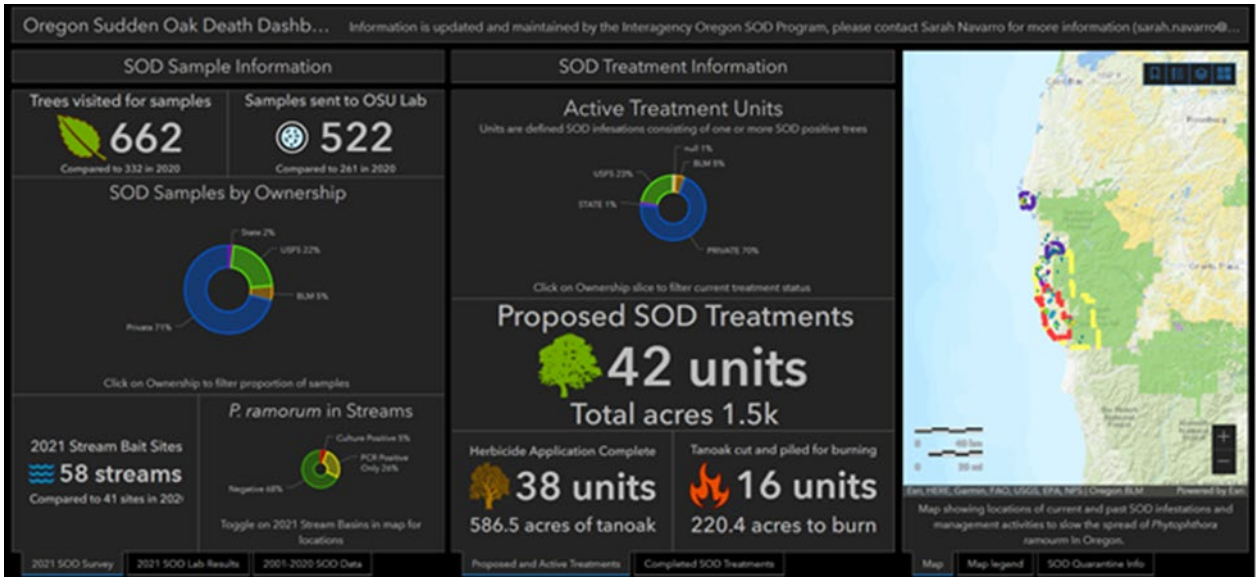

Figure 1. Treatment and monitoring information for sudden oak death in Oregon as displayed in the Oregon SOD Dashboard.

MONITORING

Stream monitoring for *P. ramorum* in California. In 2021, four streams in Humboldt County, Yager Creek, Stanley Creek, Widow White Creek, and Mill Creek near Azalea Ave., tested positive for *P. ramorum*. The results are from a total of 58 streams that were monitored across north and central coastal California, by the Rizzo lab, UC Davis and collaborators from multiple institutions. *P. ramorum* was identified in the streams in the April sampling, but no positives were detected in March, May, and June. All four of the creeks had been positive previously. Stream monitoring sites were selected to maximize detection of *P. ramorum* spread into high-risk and high-value forests, particularly at the boundaries of the pathogen's known range in Humboldt and Del Norte Counties, and in the south, in San Luis Obispo County. The pathogen was not detected in San Luis Obispo County. Funding for California *P. ramorum* stream

monitoring is provided by the U.S. Forest Service, Pacific Southwest Region, Forest Health Protection.

Eastern U.S. Cooperative Sudden Oak Death Early Detection Stream Survey mid-year results. For 2021, twelve eastern states (AL, FL, GA, IL, MD, MS, NC, PA, SC, TX, WI, and WV) are participating in the yearly USDA Forest Service, Cooperative Sudden Oak Death Early Detection Stream Survey (Table 1). During the spring season survey (February to June), 403 bait samples were collected from 79 streams in these states. PCR analysis of the samples detected *P. ramorum* from two streams in Alabama. Both positive streams were associated with nurseries previously positive for *P. ramorum*. All the other samples were negative. For more information contact Bruce Moltzan, bruce.moltzan@usda.gov.

Table 1. Number of streams surveyed in eastern states for USDA Forest Service, Cooperative Sudden Oak Death Early Detection Stream Survey in 2021 from February to June 2021.

Year	AL	FL	GA	IL	MD	MS	NC	PA	SC	TX	WI	WV	Total
2021	9	3	10	7	7	5	5	5	8	9	9	2	**79**

NURSERIES AND MANAGED LANDSCAPES

Oregon Department of Food and Agriculture (ODA) *P. ramorum* program update. At the start of 2021, ODA's *Phytophthora ramorum* program included eight interstate shippers under federal compliance agreements (7 CFR 301.92; located in Polk (1), Washington (1), Marion (4), Columbia (1), and Lane (1) Counties) and two intrastate shippers, which are regulated under Oregon state quarantine and federal requirements (OAR 603-052-1230 and 7 CFR 301.92; located in Clackamas and Lincoln Counties). The 2021 spring season marked the sixth consecutive inspection with no *P. ramorum* detected at the three interstate shippers and at both intrastate shipper nurseries. All were formally released of state and federal program inspection requirements. One nursery in Lane County closed and is no longer operating. ODA officials have confirmed that all plant material at that location has been destroyed.

Over the summer, ODA completed steaming projects at three different nurseries where infested soil had been confirmed during previous delimitation inspections. Nursery A (Washington County) had four adjacent hoop houses that were steamed. One house had a soil positive and the adjacent house had only one confirmed positive plant (no soil positive). Normally, ODA would only have steamed one of those hoop houses. However, due to an irrigation incident at the nursery which flooded all four houses, ODA chose to steam all the flooded areas as an extra precaution. This work took four weeks. The other two nurseries were steam treated and work was completed by mid-September.

Fall compliance inspections are planned to begin in early October. At present, there are only four nurseries in the program. The program has experienced some staff changes. Melissa Lujan, long time Field Coordinator, left for another position in the ODA Nursery program. In September, Kaitlin Gerber joined the ODA as the new *P. ramorum* Program Field Coordinator. Kaitlin comes from the nursery industry, where she was an assistant manager at a conifer nursery.

Washington State Department of Agriculture (WSDA) *P. ramorum* program update. WSDA conducted a fall certification survey in late September for an interstate shipping nursery under compliance. Lab results are pending. For more information contact Scott Brooks at SBrooks@agr.wa.gov.

FUNDING - MANAGEMENT

Environmental Quality Incentives Program (EQIP) financial assistance is available to combat sudden oak death on private lands in Curry County, OR. The USDA Natural Resources Conservation Service (NRCS), in partnership with the Oregon Department of Forestry (ODF), is offering financial and technical assistance to help landowners perform a suite of conservation treatments that can slow the spread of *P. ramorum*. The treatments may include removal of infected trees, woody residue treatment, site preparation for planting, and replanting of more resistant trees. Since 2010, there have been eleven OR SOD EQIP contracts issued covering over 322 acres. A total of $668,026 has been allocated to treat and restore infested sites on private lands in Oregon. Funding is available for 2022. For more information contact Katie Woodruff, NRCS Coquille field office, Katlyn.woodruff@usda.gov.

RESEARCH

Elliott, M.; Strenge, D.; Hulbert, J. and Chastagner, G. 2021. Multiagency collaboration strengthens applied research and mitigation of *Phytophthora ramorum* at a botanical garden in Washington State. Plant Health Progress. https://doi.org/10.1094/PHP-02-21-0045-FI.

Phytophthora species pose significant challenges to public gardens, but collaboration can help contaminated gardens minimize their impacts and remain open to the public. *Phytophthora ramorum* was detected at the Bloedel Reserve—a botanical garden in Washington State—in 2015, but has not been recovered from surveys of plant material since 2016 following coordinated regulatory responses, research activities and adaptative management decisions. Here we summarize efforts that were made to reduce the impact of *P. ramorum* on the Bloedel Reserve and limit the spread of this pathogen to nearby landscapes. Regulatory responses included detection and removal of positive plants, soil steaming and the development of best management practices in the Reserve. Measures to adapt management in the garden included supporting applied research, removal of host plants, fungicide sprays, trail maintenance and signage. The garden also featured *P. ramorum* in their education and outreach programs and used this as an opportunity to teach the public about invasive species.

Gaydos, D.A.; Jones, C.M.; Jones, S.K.; Millar, G.C.; Petras, V.; Petrasova, A.; Mitasova, H. and Meentemeyer, R.K. 2021. Evaluating online and tangible interfaces for engaging stakeholders in forecasting and control of biological invasions. Ecological Applications: e02446. https://doi.org/10.1002/eap.2446.

Ecological forecasts will be best suited to inform intervention strategies if they are accessible to a diversity of decision-makers. Researchers are developing intuitive forecasting interfaces to guide stakeholders through the development of intervention strategies and visualization of results. Yet, few studies to date have evaluated how user interface design facilitates the coordinated, cross-boundary management required for controlling biological invasions. We used a participatory approach to develop complementary tangible and online interfaces for collaboratively forecasting biological invasions and devising control strategies. A diverse group

of stakeholders evaluated both systems in the real-world context of controlling sudden oak death, an emerging forest disease killing millions of trees in California and Oregon. Our findings suggest that while both interfaces encouraged adaptive experimentation, tangible interfaces are particularly well-suited to support collaborative decision-making. Reflecting on the strengths of both systems, we suggest workbench-style interfaces that support simultaneous interactions and dynamic geospatial visualizations.

Rosenthal, L.M., Fajardo, S.N. and Rizzo, D.M. 2021. Sporulation potential of *Phytophthora ramorum* differs among common California plant species in the Big Sur region. Plant Disease. https://doi.org/10.1094/PDIS-03-20-0485-RE.

Sudden oak death (SOD), caused by the generalist pathogen *Phytophthora ramorum*, has profoundly impacted California coastal ecosystems. SOD has largely been treated as a two-host system, with *Umbellularia californica* as the most transmissive host, *Notholithocarpus densiflorus* less so, and remaining species as epidemiologically unimportant. However, this understanding of transmission potential primarily stems from observational field studies rather than direct measurements on the diverse assemblage of plant species. Here, we formally quantify the sporulation potential of common plant species inhabiting SOD-endemic ecosystems on the California coast in the Big Sur region. This study allows us to better understand the pathogen's basic biology, trajectory of SOD in a changing environment, and how the entire host community contributes to disease risk. Leaves were inoculated in a controlled laboratory environment and assessed for production of sporangia and chlamydospores, the infectious and resistant propagules, respectively. *P. ramorum* was capable of infecting every species in our study and almost all species produced spores to some extent. Sporangia production was greatest in *N. densiflorus* and *U. californica* and the difference was insignificant. Even though other species produced much less, quantities were nonzero. Thus, additional species may play a previously unrecognized role in local transmission. Chlamydospore production was highest in *Acer macrophyllum* and *Ceanothus oliganthus*, raising questions about the role they play in pathogen persistence. Lesion size did not consistently correlate with the production of either sporangia or chlamydospores. Overall, we achieved an empirical foundation to better understand how community composition affects transmission of *P. ramorum*.

Rosenthal, L.M.; Simler-Williamson, A.B. and Rizzo, D.M. 2021. Community-level prevalence of a forest pathogen, not individual-level disease risk, declines with tree diversity. Ecology Letters. https://doi.org/10.1111/ele.13871.

Understanding why diversity sometimes limits disease is essential for managing outbreaks; however, mechanisms underlying this 'dilution effect' remain poorly understood. Negative diversity-disease relationships have previously been detected in plant communities impacted by an emerging forest disease, sudden oak death. We used this focal system to empirically evaluate whether these relationships were driven by dilution mechanisms that reduce transmission risk for individuals or from the fact that disease was averaged across the host community. We integrated laboratory competence measurements with plant community and symptom data from a large forest monitoring network. Richness increased disease risk for bay laurel trees, dismissing possible dilution mechanisms. Nonetheless, richness was negatively associated with community-level disease prevalence because the disease was aggregated among hosts that vary in disease susceptibility. Aggregating observations (which is surprisingly common in other dilution effect

studies) can lead to misinterpretations of dilution mechanisms and bias towards a negative diversity disease relationship.

Weinberg, W.C.; Suoja, J.R.; Kerhoulas, L.P.; Maberry, R.J.; Lee, C.A.; Baston, D.S. and Marshall, S.E. 2021. *Phytophthora ramorum* foliar infection reduces leaf-level productivity in tanoak and California bay: a pilot study from Redwood National Park. Madroño. 68(2): 99–108.

Woody plant infections of the pathogenic oomycete *Phytophthora ramorum* Werres, DeCock, & Man in't Veld have brought an uncertainty to the future of western forests. Two understory hardwoods, tanoak (*Notholithocarpus densiflorus* (Hook. and Arn.) Manos, C.H. Cannon, and S. Oh) and California bay (*Umbellularia californica* (Hook. & Arn.) Nutt.), are commonly infected with *P. ramorum* leaf infection, the nonfatal foliar form of this pathogen. As the fatal bole infection form of this pathogen is most commonly studied, comparatively little research has been conducted on the nonfatal foliar infection form. This study measured physiological characteristics (midday water potential, stomatal conductance, net photosynthesis, and water-use efficiency) of healthy and infected foliage from tanoak and California bay trees in Redwood National Park to determine the effects of *P. ramorum* foliar infection on leaf-level productivity. For both species, midday water potential, stomatal conductance, and net photosynthesis were all lower in infected samples compared to healthy samples. There was no significant difference in instantaneous water-use efficiency between infected and healthy foliage. Results suggest that *P. ramorum* leaf infection can lower leaf-level productivity and water status. Further research on the subject is still needed to better support informed management decisions in infected forests and to predict the long-term effects of *P. ramorum* leaf infections across a diverse suite of host species in the Pacific Northwest.

RELATED RESEARCH

Crous, P.W.; Groenewald, J.Z.; Rooney-Latham, S.; Blomquist, C.L. 2021. *Calonectria californiensis* Crous & Roon.-Lath., sp. nov. Persoonia: Molecular Phylogeny and Evolution of Fungi. 46:412-413. https://doi.org/10.3767/persoonia.2021.46.11.

A"Fungal Planet" description sheet for a newly named fungus that causes a leaf spot on California bay laurel, *Umbellularia californica,* is now available. For more information contact suzanne.latham@cdfa.ca.gov or cheryl.blomquist@cdfa.ca.gov.

MacArthur-Waltz, D.J.; Nelson, R.A.; Lee, G. and Gordon, D.M. 2021. Tree preference and temporal activity patterns for a native ant community in an urbanized California woodland. Journal of Insect Behavior. https://doi.org/10.1007/s10905-021-09778-w.

Contains a short discussion of sudden oak death's effects on ant populations in coast live oak stating, "sudden oak death may pose a serious threat to the diversity of native ants in this ecosystem."

PERSONNEL

Gabriela Ritokova is the new forest pathologist for the Oregon Department of Forestry replacing Sarah Navarro. Gabi is stationed in Salem and started in September. Gabi brings years of experience from work at Oregon State University on Swiss needle cast and other forest health issues. She may be contacted at Gabriela.RITOKOVA@oregon.gov.

RECORDED MEETINGS - RESOURCES

Recordings of the 2021 annual meetings of the California Oak Mortality Task Force & Phytophthoras in Native Habitats Work Group, held online September 21 – 23, are now available. Updates include progress to address the NA2 sudden oak death infestation in Oregon, eucalyptus decline in the Bay Area, and other current forest health concerns. The Phytophthoras in Native Habitats Work Group meeting featured short talks on the theme of managing Phytophthoras in open space areas and nurseries. For questions contact Janice Alexander, jalexander@ucanr.edu.

- Day 1 (9/21/21): short presentations on sudden oak death, Bay Area tree decline, and a review of other plant health concerns (1.5 hrs)
- Day 2 (9/22/21): COMTF Executive Committee reports (1.5 hrs)
- Day 3 (9/23/21): CalPhytos meeting with presentations concerning Phytophthoras in restoration and natural areas (2 hrs)

"Sudden Oak Death in Port Orford", a 2-part webinar organized by Oregon State University Extension is now available online. The webinars were held in September and targeted residents of Port Orford. Basic biology of sudden oak death is reviewed and photos, maps, and treatment plans for the NA2 Port Orford infestation are explained. The recorded sessions may be found HERE.