

CALIFORNIA OAK MORTALITY TASK FORCE REPORT FEBRUARY 2024

EDITOR'S NOTE. IN THIS ISSUE, WE SUMMARIZE THE STATUS OF *Phytophthora ramorum* in 2023 FOR OREGON FORESTS, EASTERN U.S. WATERWAYS, NURSERIES AND LANDSCAPES.

Monitoring and Management in Oregon - 2023 year in review

To monitor sudden oak death (SOD) spread and detect new infestations, the Oregon SOD program relies on multiple survey methods conducted throughout the year, including aerial detection surveys augmented by high-resolution digital imagery and ground verification, ground-based transects, and stream monitoring.

In July 2023, the U.S. Forest Service/Oregon Department of Forestry cooperative aerial detection survey team conducted a fixed-wing survey, followed by a helicopter survey across forested lands in Curry County, to monitor disease spread and detect new infestations. The aerial surveys covered 787,500 acres of forested land. To complement these surveys, foresters began analysis of 2023 high-resolution imagery outside of the Generally Infested Area (GIA) to identify declining or dead tanoak trees. The imagery project area now covers approximately 539,000 acres (842 square miles), covering the region between the California border and Coos County.

Ground surveys covered 860 acres with 518 trees campled, of which 117 were positive for *Phytophthora ramorum*. SOD foresters conducted ground transect surveys covering 210 acres for the harvest of disease-free tanoak on private lands. Tanoak harvest is only allowed following the issuance of a special permit by the Oregon Department of Agriculture under OAR 603-052-1230, Oregon's *P. ramorum* quarantine.

Other SOD survey and detection efforts within and adjacent to the quarantine area (Fig. 1) in 2023 included monitoring 63 stream bait sites (Fig. 2). Since the installation of stream baits in May 2023, 26 streams tested positive for *P. ramorum* at least once during the 7-month baiting period.





Figure 1. Status of SOD quarantine zone and three-mile emergency quarantine areas in 2024, along with the SOD Generally Infested Area and positive *P. ramorum*-infected trees detected from 2021-2023.



Figure 2. 2023 Oregon P. ramorum stream bait sites.

Efforts to quarantine and slow the spread of *P. ramorum* continue along the southwestern Oregon coast. Twenty-nine new infestations have been detected beyond the GIA in 2023.



Assuming a 600-ft treatment buffer inclusion, the treatment area for the 2023 infections totals approximately 526 acres on State and private lands and 141 acres on federal lands. Since the 2021 detection of the third clonal lineage of *P. ramorum* (NA2) outside the quarantine zone, new infestations have been detected within Humbug Mountain State Park and, more recently, south of Port Orford in the Hubbard Creek drainage. In 2023, 59 samples from the Humbug Mountain area tested positive for *P. ramorum*, and treatments have followed on 165 acres of private and State lands.

In the treatment area within the Port Orford infestation, 347 acres have been treated, 56 acres are currently under active treatment, and another 477 acres remain untreated (based on 600-ft buffers around trees positively identified as being *P. ramorum* infected).

From 2001 through 2023, the Oregon Department of Forestry's Slow the Spread SOD program has completed eradication treatments on more than 9,000 acres at an estimated cost of over \$37 million. Federal lands comprised 28% of treated acres; the remaining area was private and State lands. For additional information, contact Gabriela Ritokova, Gabriela BITOKOVA@odf oregon gov or Sarah Navarro@usda.gov

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MONITORING – EASTERN U.S. STREAM SURVEY

In 2023, 63 streams in ten eastern U.S. states (AL, FL, GA, IL, MD, MS, NC, PA, SC, and TX) were surveyed in the USDA Forest Service, Cooperative Sudden Oak Death Early Detection Stream Survey (Table 1). Of 557 baited samples, PCR analysis detected *Phytophthora ramorum* from two streams in AL, one stream in MS, and one stream in NC. All positive streams were associated with nurseries previously positive for *P. ramorum*.

Table 1. Number of streams surveyed in eastern states for USDA Forest Service, Cooperative Sudden OakDeath Early Detection Stream Survey in 2023.

Year	AL	FL	GA	IL	MD	MS	NC	PA	SC	ТХ	Total
2023	9	3	10	5	8	4	6	6	8	4	63

For the last five years (2019-2023), *P. ramorum* has been detected from eight streams in four states—five streams in AL, one stream in MS, one stream in NC, one stream in SC (Table 2). The pathogen has been present in these streams for longer than ten years except for the recent detection in SC.

Table 2. Streams in eastern states positive for the sudden oak death pathogen from USDA Forest Service,Cooperative Sudden Oak Death Early Detection Stream Surveys from 2019 to 2023

Stream	AL-	AL-	AL-	AL-	AL-	MS	NC	SC	Total
	a	b	c	d	e				
2019	+	+	+	+	+	+	+	-	7
2020	-	-	-	-	-	-	-	-	0
2021	+	-	+	-	-	-	-	-	2
2022	-	-	+	+	+	-	-	+	4
2023	-	-	+	+	-	+	+	-	4



Residential area and streamside vegetation within the watershed of the positive stream in SC have been surveyed multiple times. All samples collected so far, including plant, soil, and run-off water, were negative for *P. ramorum*, and the source of inoculum in the positive stream could not be determined. A culture isolate from the stream survey was genotyped, and it belongs to NA1 lineage. Credit for genotyping goes to Dr. Nik Grunwald's lab at Oregon State University/USDA Agricultural Research Service.

Monitoring and Management in the United Kingdom – 2023 year in review

Here follows a brief operational summary of *Phytophthora ramorum* 2023 surveillance from each of the four UK countries. A general summary of *Phytophthora ramorum* in UK forests is available here: <u>Ramorum disease (Phytophthora ramorum) - Forest Research</u>.

ENGLAND

The 2023 *P. ramorum* aerial surveillance program surveyed over 31,000 ha (>76,000 ac) of larch across England. This generated around 280 targets for follow-up investigation on the ground. Similar to the 2022 season, the most affected areas of England were the southwest and northwest, with low numbers of sites identified in other areas, predominantly near previously known infested sites. In many cases, ground visits ruled out *P. ramorum*, and it appears that the total number of infested sites for 2023 is considerably lower than that of 2022 (approx. 200) although not all 2023 Statutory Plant Health Notices have yet been issued. The less conducive weather conditions for sporulation in 2021 and 2022 seem to have led to a reduced level of disease in 2022 and 2023, with generally lower levels of symptoms observed on affected sites than in 2020 and 2021 (Fig. 3). Investigations have been undertaken to try to establish the significance of *P. pseudosyringae* as a pathogen on larch following observations at a number of larch locations. In the north of England a small number of sites with severe symptoms have yielded presence of only *P. pseudosyringae* or in some instances both *P. pseudosyringae* and *P. ramorum* from samples. For more information, contact Barnaby Wylder, Forestry Commission, Barnaby.Wylder@forestrycommission.gov.uk.



Figure 3. Examples of symptoms observed in smaller (SW England; top photo) or larger larch woodland (Lake District; bottom photo) in 2023.



SCOTLAND

Scottish Forestry continues to support Scotland's forests with widespread aerial and ground surveillance programs for *Phytophthora ramorum*. The number of sites visited in 2023 has been broadly similar to the numbers seen since 2018, and positive findings of the disease have also tracked along this arc. It has been noticed that where positive findings have been found and Statutory Plant Health Notices (SPHNs) have not been complied with quickly, localized spread of the disease has occurred, amounting to further SPHNs being issued in the localized area. In contrast, if the SPHN has been complied with quickly, the risk of spread is significantly reduced. It's a reminder that if we can get diseased trees felled quickly, there is less risk of further spread. A *P. ramorum* SPHN update map can be found here: Scottish Forestry - Phytophthora ramorum in Scotland. For more information, contact Cameron McIntyre, Scottish Forestry, Cameron.Mcintyre@forestry.gov.scot.

WALES

Across Wales there were four helicopter flights across the 2023 survey season which identified approximately 150 sites to investigate (Fig. 4). All sites were visited and there were approximately 60 positive sites for *P. ramorum*, mainly on larch but with a couple of noble fir (*Abies procera*) as well. These were issued with Statutory Plant Health Notices, which require destruction (normally felling) of the trees by 31st March 2024. This means it has been a quieter year; infection seems less than previous years, but we now tend to be dealing with smaller forest blocks. There has been no major expansion from known infested areas. The weather has been wet and mild this autumn and winter until now (early January), which has led to increased optimal conditions for sporulation, which may result in a larger number of infections for 2024. The Welsh Government is working on a *P. ramorum* strategy refresh - this probably won't be complete until autumn 2024. For more information, contact Joseph McMinn, Natural Resources Wales, joe.mcminn@cyfoethenaturiolcymru.gov.uk.



Figure 4. Distribution of P. ramorum Statutory Notices – Wales.



NORTHERN IRELAND

In Northern Ireland in 2023, two survey flights were carried out in June and September. The flights identified 49 locations for follow-up by inspectors. The aerial survey back-to-office report indicated *P. ramorum* was still active and spreading in forests in Northern Ireland. Many sites identified for follow-up in 2023 were located in forests where *P. ramorum* had previously been identified. Plant Health Legislation applicable in Northern Ireland is aligned with the European Union, therefore distinct from Great Britain, so *P. ramorum* findings in Northern Ireland are no longer subject to Statutory Plant Health Notices. At two locations where *P. ramorum* was suspected, aerial surveillance follow-up inspections and sampling of larch confirmed *Phytophthora pseudosyringae* (Figure 5 shows an example comparison between 2022 and 2023). For 2024, larch samples submitted will be tested for both *P. ramorum* and *P. pseudosyringae*. For more information, contact Aoife Smith, Department of Agriculture, Environment and Rural Affairs, Aoife.Smoth@daera-ni.gov.uk.



Killens June 2022 and June 2023

Figure 5. Northern Ireland – Comparison of P. pseudosyringae symptoms on larch in 2022 and 2023.

NURSERIES AND MANAGED LANDSCAPES - 2023 YEAR IN REVIEW

California Department of Agriculture *P. ramorum* **Nursery Program 2023 summary report.** The California Department of Food and Agriculture (CDFA) receives funding from the United States Department of Agriculture (USDA) to administer the cooperative *Phytophthora ramorum* program. The CDFA assists and reimburses the county agricultural commissioners as they enforce Federal Domestic Quarantine 7 CFR 301.92 and California Code of Regulations 3700 regulations at the 317 establishments regulated for *P. ramorum* in California (Table 3). Program funding allocated to CDFA for the *P. ramorum* program is \$1,308,771 for fiscal year 2023/2024.



Table 3. T	otal Establishments	Under	Compliance	for P	P. <i>ramorum</i> in	California.
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Establishment Type	Number of Establishments
Host/Non-host Nursery Stock in Soil	
(Exhibit B and Exhibit J)	192
Greenery, Garland, and Wreaths (Exhibit D)	8
Tree Farm (Exhibit I)	11
Non-Nursery Establishments (<i>Exhibits C, F, GW2, GW4, GW6, GW10, and GW12</i>)	106
Total	317

Approximately 7,400 *P. ramorum* program regulatory samples were submitted to the CDFA Plant Pest Diagnostics Laboratory for processing in 2023. There were 78 samples that were determined to be positive for *P. ramorum* in 2023.

Year	Nonquarantine	e Counties	Quarantine	Quarantine Counties				
	Production	Retail	Production	Retail				
2023	0	1	5	1	7			
2022	0	0	0	0	0			
2021	1	0	2	0	3			
2020	2	0	3	0	5			
2019	2	3	5	5	15			
2018	2	3	2	4	11			
2017	1	3	5	7	16			
2016	1	0	0	1	2			

Table 4. P. ramorum-Positive Nurseries in California by Year.

In 2023, two nurseries that were previously positive and receiving enhanced biannual inspections completed the required six negative inspections necessary to be released from the enhanced inspection portion of the program and will revert to annual inspections in 2024. There are currently six previously positive California nurseries receiving enhanced biannual inspections. For more information contact Carolyn Lambert, Carolyn.Lambert@cdfa.ca.gov.

Oregon Department of Agriculture *P. ramorum* **Nursery Program 2023 summary report.** In 2023, the Oregon Department of Agriculture (ODA) *Phytophthora ramorum* Nursery Program worked with five interstate shippers under federal compliance agreements (7 CFR 301.92). Those nurseries are in the following counties: Washington (2), Columbia (1), and Marion (2). The ODA also held a compliance agreement with one intrastate shipper in Clackamas County, which is regulated under Oregon state quarantine requirements (7 CFR 301.92 and OAR 603-052-1230). Table 5 summarizes ODA's results for the work described in this report. Table 6 lists plant species with *P. ramorum* detections from nurseries under federal and state compliance agreements in 2023.



	Foliar		Wa	ter	Soil		
	Survey Type	Sampled	Pr (+)	Sampled	Pr (+)	Sampled	Pr (+)
	Compliance	1,228	10	4	0	0	0
Spring	Trace	0	0	0	0	0	0
	CNP*	504	36	3	0 0 0 0 0 0	0	
	Compliance	1,664	0	0	0	0	0
Fall	Trace	0	0	0	0	0	0
	CNP*	0	0	0	0	0	0
	TOTAL	3,396	46	7	0	0	0

 Table 5. Results from surveys conducted at nurseries in Oregon under federal and state compliance surveys.

 *CNP is Confirmed Nursery Protocol survey.

Spring compliance surveys were completed by the end of May. The ODA tested 1,228 foliar samples for *P. ramorum*, of which ten tested positive. The Confirmed Nursery Protocol (CNP) delimitations resulted in an additional 334 foliar sample collected, 25 of which tested positive. The nursery incinerated all plants in the destruction and quarantine zones and will opt for non-host placement as their soil mitigation method.

As part of an annual inspection conducted in April, one nursery in Washington County was determined to have plants impacted by *P. ramorum*. A total of 167 foliar samples were taken as part of the delimitation process associated with the CNP, and ten additional positive plants were detected. All plants have been incinerated to ash on site, and soil mitigation included solarization and non-host placement to previously positive areas.



Figures 6 & 7. P. ramorum positive salal 'Oregon Wintergreen' and field grown Prunus laurocerasus.



Table 6. Known regulated plants that were confirmed positive for *P. ramorum* from surveys conducted at nurseries in Oregon under federal and state compliance in 2023.

Genus/Species	Cultivar(s)
Rhododendron	'PjM', Busy House', 'Star Bright Champaign', 'Golden Gate', 'Seaview Sunset', 'Nancy Evans', 'Mission Bells', 'Peach Charm', 'Cheer', 'Ken Janacek', 'Sumatra', 'Mrs. Furnivall's Daughter', 'Hochman's Polaris', 'Bali', 'Everette', 'Torch', 'Crimson Pippin', 'Mardi Gras', 'Blue Baron', 'Loderi King Gorge', 'Top Banana', 'PJM Elite', 'PJM Regal', 'Nancy Evans', 'Marron Bells', 'El Camino', 'Pink Macrantha', 'Blue jay', 'Peppermint Tree', & 'Princess Maxima'
Viburnum tinus	'Spring Bouquet'
Pieris japonica	'Mountain Fire'
Arbutus unedo	'Compacta'
Salal	Oregon Wintergreen
Prunus laurocerasus	
Euonymus marginata	

Fall compliance surveys were completed by end of November. The ODA tested 1,664 foliar samples for *P. ramorum*; none of which tested positive. For more information, please contact Chris Benemann, chris.benemann@oda.oregon.gov or Kaitlin Gerber, kaitlin.gerber@oda.oregon.gov.

Washington State Department of Agriculture (WSDA) *P. ramorum* **2023 summary report.** In 2023, the Washington State Department of Agriculture (WSDA) processed over 300 plant, soil, and water samples collected within the state (see Table 7 below). Washington's only regulated nursery for *P. ramorum* was released from their federal compliance agreement in March 2023 after six consecutive negative certification surveys. Spring and fall surveys had been conducted at the nursery since 2019. WSDA inspected five of the nine nurseries that 'opted-out' of the Federal DA-2014-2 regulations and can no longer ship interstate. Host material appeared free of symptoms and no samples were collected, and WSDA confirmed none of the 'opt-out' nurseries are shipping interstate.

WSDA Plant Services staff conducted three trace-forward investigations and collected symptomatic plant samples from out of state positive nurseries; all samples were negative. Staff also conducted the required follow-up inspection at a residential site in Pacific County that was positive in 2022 as the result of a trace-forward. No symptoms were present on host plants in the perimeter of the property, and no samples were collected. For more information contact Scott Brooks, SBrooks@agr.wa.gov.



Table 7. Washington state total 2023 sample summary collected or tested by WSDA.

TOTAL SAMPLING IN 2023

Total number of regulatory samples collected (all sites)	319	
Total number of nursery samples collected	19	
Total number of non-nursery samples collected	300	
Total number of confirmed positive PLANT samples (2023)		
Total number of confirmed positive SOIL samples (2023)	0	
Total number of confirmed positive WATER samples (2023)	0	

SAMPLING (WA Department of Natural Resources Stream Baiting tested by WSDA)

Total number of DNR stream baiting samples collected	66
Total number of DNR confirmed positive water samples	0

RESEARCH

Dun, H.F.; MacKay, J.J. and Green, S. 2024. Expansion of natural infection of Japanese larch by *Phytophthora ramorum* shows trends associated with seasonality and climate. Plant Pathology. 73(2): 419-430.

Phytophthora ramorum is an invasive oomycete pathogen that has been causing significant mortality of larch trees (*Larix* spp.) in the United Kingdom since 2009. This is the first multiyear study of the natural infection processes of *P. ramorum* on Japanese larch (*Larix kaempferi*) and the factors influencing disease progression. Field surveys in south-west Scotland, which suffered an extensive epidemic in 2012 from a highly virulent new lineage (EU2), allowed detailed examination of how *P. ramorum* infects individual trees and spreads across a site over an extended time period. A marked expansion of the disease in spring 2018 allowed us to consider how environmental conditions influence outbreaks, with summer precipitation and spring storms found to be significant factors. Field observations revealed that buds on fine shoots appeared to be the primary infection sites with infection and spread of *P. ramorum* were not consistent within or between sites and it is likely that site-specific factors influence the spread of infection and subsequent mortality. The climatic conditions identified in this study could help predict future disease expansions and inform the development of management strategies for larch in the UK.

Kline, N.; Cushing, T. and Grand, L. 2024. Understanding landowner education needs for invasive disease prevention and restoration planting in southern Oregon. Journal of Forestry. DOI: <u>https://doi.org/10.1093/jofore/fvad061 (Early View).</u>

Understanding the knowledge and behavior of nonindustrial private forest landowners towards Port-Orford cedar (POC) root disease (*Phytophthora lateralis*), sudden oak death (*Phytophthora ramorum*), and disease-resistant seedlings can help target effective education and outreach programs. We surveyed two counties in Southern Oregon to gain knowledge about these pathogens, disease-resistant seedlings, landowner behavior, and landowner preferences regarding planting disease-resistant seedlings. Amenity-based management objectives were more associated with planting disease-resistant POC. Respondents were more likely to plant diseaseresistant conifers than hardwoods. Disease-resistant planting preferences were associated with years owned and acres of ownership. Designing targeted education and outreach programs will be necessary to achieve broad scale adoption of disease management and restoration practices.

Thomsen, I.M.; Alsanius, B.; Flø, D.; Krokene, P.; Wendell, M.; Wright, S.A.I.; Magnusson, C.; Stenberg, J.; Børve, J.; Nybakken, L.; Nicolaisen, M. and Sæthre, M.G. 2023. Updated pest risk assessment of *Phytophthora ramorum* in Norway. Scientific Opinion of the Panel on Plant Health of the Norwegian Scientific Committee for Food and Environment. Oslo, Norway.

Xuechung, K.; Wei, C.; Siliang, L.; Tiejun, W.; Le, Y. and Singh, R. 2024. Spatiotemporal distribution of sudden oak death in the US and Europe. Agricultural and Forest Meteorology. 346: 109891.

Sudden Oak Death (SOD) is a devastating forest disease caused by *Phytophthora ramorum*, leading to rapid branch and leaf wilting. This study analyzed SOD data from various sources to study the spatiotemporal distribution of this pathogen globally. The spatial autocorrelation analysis shows that seven counties in the US have positive spatial correlations with high clustering values, whereas, the other six counties have negative correlations with low clustering values. In Europe, the regions with positive spatial correlations with high clustering values are located in England, Scotland, southern Finland, northern Germany, western France, and northern Spain, and many areas show negative correlations with low clustering values. The results of time series analysis reveal a clear seasonal pattern of pathogen incidence in the western US, with the peak of pathogen occurrences mainly in May and June. Furthermore, our spatiotemporal permutation scanning approach detects six clusters in the US and four in Western Europe during 2005–2006, 2012–2013, and 2021, providing insight into temporal dynamics and geographical hotspots of SOD. Our study also explored the impact of El Niño-Southern Oscillation (ENSO) on SOD for the first time, revealing a lag correlation up to 6 months. By improving our understanding of SOD spatiotemporal patterns and dynamics, we can better predict future trends and mitigate its impact. We recommend strengthening priority protection of host plants in areas where SOD outbreaks were clustered during La Niña events, and containing outbreak risks through effective detection, early warning and isolation of susceptible plants. This study provides a basis for global forest protection and disease prevention efforts to save susceptible plants.