



CALIFORNIA OAK MORTALITY TASK FORCE REPORT AUGUST 2014

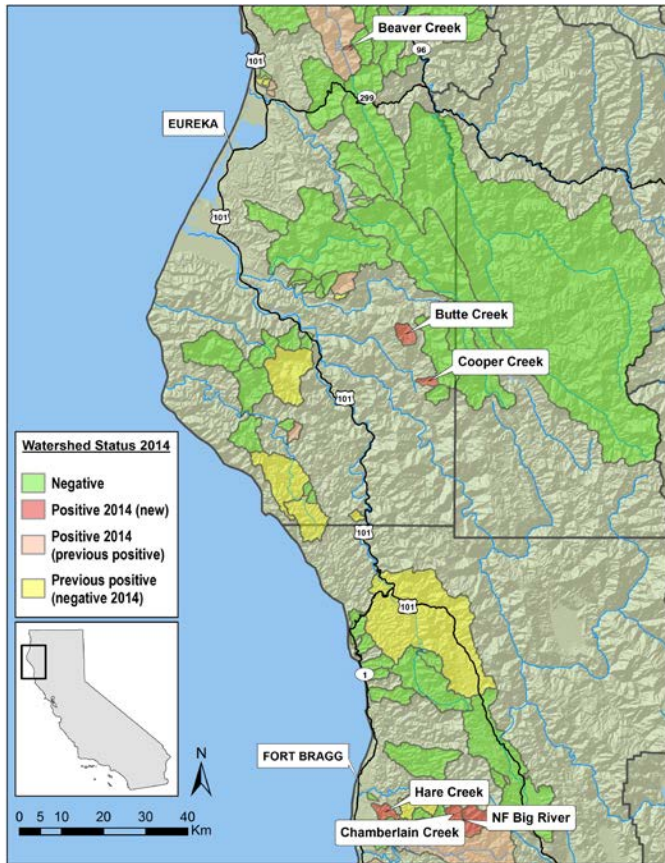
MONITORING

Sudden oak death has been confirmed in a remote location of Redwood National Park (RNP) in northern Humboldt County. The 34-acre infestation site is located at the confluence of Redwood and Bridge Creeks and occurs within 1 mile of the park's Tall Trees Grove. The disease is occurring in a mixed old growth/second growth redwood forest with alder, maple, and tanoak as well as California bay laurel (occurs primarily along the riparian zone). Scattered within the infestation zone, up to a dozen tanoak trees have already succumbed to the disease, with more expected to die in the next year. This new infestation is located approximately 11 miles north of the Redwood Valley SOD site, which is also located along Redwood Creek.

Park management has developed a preliminary emergency treatment response to contain the outbreak and protect the park's tanoak resources. This fall, park personnel plan to cut down all tanoak and bay within the infestation area as well as those occurring within a 100-meter buffer zone. All stumps would then be treated with an herbicide to reduce sprouting. Early detection monitoring for the pathogen will also be implemented next year to help initiate a rapid response for any new outbreaks identified in the park. For more information, contact Leonel Arguello, Chief of Vegetation Management, Redwood National Park, at 707-465-7780 or leonel_arguello@nps.gov.

2014 California Stream Monitoring Update – *Phytophthora ramorum* was detected for the first time in six watersheds in Humboldt (3) and Mendocino (3) Counties, despite only 13 (54%) of 24 previously positive CA sites testing positive for the pathogen (likely a consequence of low rainfall throughout the state). Recovery was lowest in Monterey County (1 of 5; 20%), while confirmations in Humboldt (6 of 12; 50%) and Mendocino (6 of 7; 86%) Counties remained relatively high.

In northern Humboldt County, *P. ramorum* was detected for the first time in Beaver Creek, a Redwood Creek tributary located upstream of Cookson Ranch. In central Humboldt County, first-time detections were made in two creeks near the Six Rivers National Forest boundary - Butte Creek (Van Duzen River watershed) and Cooper Creek (Eel River watershed). Mendocino County had two new watershed detections in the Jackson Demonstration State Forest - the North Fork of the Big River (along Highway 20) and Hare Creek (southeast of Fort Bragg). To determine the inoculum source in the North Fork of the Big River, the upstream tributaries of Chamberlain Creek and West Chamberlain Creek were sampled, with *P. ramorum* recovered from Chamberlain Creek.



2014 California Stream Monitoring New Watershed Confirmations. Heather Mehl, UC Davis Rizzo Lab.

From February to June, 146 sites in five counties (Del Norte-19, Humboldt-79, Mendocino-33, Monterey-7, San Luis Obispo-8) were monitored throughout northern and central coastal California. Monitoring was not conducted in the Sierra Nevada region, Sonoma, or San Benito Counties.

2014 US Forest Service California Sudden Oak Death Aerial Survey Update – While *Phytophthora ramorum*-related mortality levels are down overall as a result of statewide drought conditions, the SOD pathogen continues to spread in Humboldt County. Approximately 50,000 newly identified dead overstory tanoak were observed along the northeast front of the southern Humboldt infestation (from Phillipsville in the southwest, Alderpoint in the southeast, and Bridgeville in the north), roughly doubling the number of dead trees found in the same area a year ago. Individual dead tanoak were also seen adjacent to, and just outside of, the Redwood Creek treatment zone, and recent tanoak mortality was observed in the Mad River area. Mortality in Redway (Humboldt County) as well as southern and central Mendocino County is down by roughly 15%, with a few recently dead tanoak observed on the Jackson Demonstration State Forest near the known *P. ramorum* infestation.



Mad River Sudden Oak Death tanoak mortality. USFS 2014 SOD Aerial Survey. Photo by Zachary Heath.

Along California's central coast, including the Los Padres National Forest and the central coast range, SOD mortality levels remain similar to 2013, with 12,000 acres affected. However, in Marin and Sonoma Counties, mortality levels have dropped to 5,000 acres observed aerially (compared to 20,000 acres in 2013), with Occidental, Guerneville, and west of Healdsburg most impacted.

Of the 400,000 acres surveyed in Del Norte County, one suspect area was identified with tanoak mortality about 3 miles north of the mouth of the Klamath River. Ground surveys will follow up to determine the cause of the die-off. For more information on the aerial survey program, contact Zachary Heath at zheath@fs.fed.us.

Eleven states are participating in the 2014 National *P. ramorum* Early Detection Survey of Forests (AL, CA, FL, GA, MS, NC, NY, OR, PA, TX, and WA). Of the 360 Eastern Region Bottle of Bait (BOB) samples processed during the spring survey, there were seven found *P. ramorum* positive (AL-3; FL-1; MS-2; NC-1). Six of the positives were from streams and associated nurseries that had previous positives. One AL waterway had not been previously positive and was not associated with a stream or nursery that had previously been found positive. Follow-up terrestrial surveys are being planned to determine the inoculum source. Western Region sampling results are still pending.



Follow-up local aerial surveys were flown in San Luis Obispo County to further delimit the 30 discrete areas of individual and small clumps of dead oak trees identified within 10 miles of the coast by the USFS annual SOD aerial survey this summer. To date, ground surveys have submitted 11 samples for *P. ramorum* testing from the targeted locations. All 11 samples were negative. Surveying of the remaining locations will continue through September. Contact Kim Corella for more information at Kim.Corella@fire.ca.gov.

NURSERIES

From January 1 to June 30, 2014, *P. ramorum* was reported in 13 nurseries in 3 regulated states (CA, OR and WA) and 3 non-regulated states (NY, TX, and VA). Of the 13 positive nurseries, 7 were interstate shippers (CA-1; OR-4; WA-1; TX-1) and 6 were non-interstate shippers. The TX interstate shipping nursery was positive due to plants received from a positive CA nursery; measures were adopted to mitigate the risk. Three of the interstate shippers had shipped in the previous 6 months. Trace investigations are underway. No host plants were shipped from the positive TX nursery. *P. ramorum* was detected in *Camellia* (17), *Pieris* (8), *Rhododendron* (15), *Viburnum* (31), *Gaultheria* (14), *Prunus* (1), *Syringa* (2), and *Vaccinium* (1) as well as potting media (1), standing water on soil (6), and water (10).

Under the newly revised *P. ramorum* regulatory framework and associated protocols (January 2014, Federal Order DA-2014-02) for the interstate movement of host nursery stock from nurseries found positive since March 31, 2011, the first round of inspections and sampling has been completed. Four of the 23 qualifying nurseries in the regulated states (CA, OR, and WA) were found *P. ramorum* positive. For each nursery to retain interstate shipping status, all critical control points identified by APHIS must be addressed by mitigation measures detailed in the compliance agreement.

The revised regulations also apply to nurseries shipping host plants interstate that are located outside of CA, OR, and WA if *P. ramorum* was detected at the nursery on or after March 31, 2014. Until June 2014, *P. ramorum* has been detected in only one interstate shipper located in TX (noted above). However, as the positive plant was received by the nursery within 2 months of shipping and was detected during a trace-forward investigation, APHIS determined this to be a regulatory incident and fully mitigated during the Confirmed Nursery Protocol and quarantine period.

REGULATIONS

New Zealand has implemented emergency regulations as of August 14th regarding importation requirements for cut flowers and foliage of *Gaultheria* spp. from Canada and the US to mitigate risks of *P. ramorum*. For more information, go to <http://www.biosecurity.govt.nz/sps/transparency/notifications/index.htm>.



NEW NORTH AMERICAN NURSERY & RESTORATION SITE PLANT PATHOGEN

First identified in North America at a Monterey County nursery in 2012,

Phytophthora tentaculata (Rooney-Latham and Blomquist 2014) has since been found on nursery stock in Alameda, Butte, Placer, and Santa Cruz Counties and on outplanted stock in restoration sites in Alameda County. Affected plants to date in California include *Mimulus aurantiacus* (sticky monkey flower), *Frangula californica* (California coffeeberry), *Heteromeles arbutifolia* (toyon), and *Salvia sp.*

Phytophthora tentaculata is a known pathogen of concern in Europe, China, and Japan. A description of it is included in the USDA Animal and Plant Health Inspection Service 2010 “New Pest Response Guidelines. *Phytophthora* species in the Environment and Nursery Settings” to provide background to launch a response to detection (USDA 2010; http://www.aphis.usda.gov/import_export/plants/manuals/emergency/downloads/nprg-genericphytophthoras.pdf).

In 1993, the pathogen was first detected on *Chrysanthemum sp.*, *Delphinium sp.* and *Verbena sp.* in Germany. Since the first detection, the host list has increased to include *Gerbera jamesonii*, *Origanum vulgare*, *Santolina chamaecyparissus*, *Lavendula angustifolia*, *Chichorium intybus*, *Aucklandia lappa*, and *Calendula arvensis*.

Infected *Mimulus aurantiacus* symptoms in California nurseries and restoration sites include root and stem rot, with the roots and stem collars developing necrotic and sunken lesions with few feeder roots. In Europe and China, the pathogen is reported to cause crown, root, and stalk rot of nursery plants. Subsequently, above-ground symptoms include stunting, leaf russeting and yellowing to browning (chlorosis), defoliation and dieback of twigs, brown to black lesions girdling the basal stem and eventually, plant death.



Sticky monkey flower *P. tentaculata* symptoms. Photo by CDFA.



Pathogen movement may occur over short and long distances through infected nursery stock. As the pathogen is soil- and water-borne, it may easily spread via soil and/or water movement from infected to non-infected plants. Therefore, the use of lab-tested nursery stock and plantings found free from *P. tentaculata* is the best means to prevent pathogen introduction.

To determine the distribution and limit the spread of this new pathogen, all nurseries selling host species should be thoroughly inspected during nursery stock cleanliness inspections. All suspect samples should be submitted to the CDFA Plant Pest Diagnostics Lab in Sacramento. For more information on nursery concerns, contact Kristina Weber at (916) 654-0435 or kristina.weber@cdfa.ca.gov.

These detections are of particular concern for ecologists since the infested nurseries specialize in native plants for restoration; consequently, plants move directly from these nurseries to wildlands, so risk of pathogen introduction to forests is very high. Conservation nursery plants are also often held to a lower aesthetic standard than ornamental plants, so weak plants are less likely to be culled.

The USDA Forest Service, Pacific Southwest Research Station, and Forest Health Protection, Washington Office; California Department of Food and Agriculture; and Phytosphere Research are cooperating on a survey to check restoration sites to determine the extent of introduced infestations. A few conservation nurseries will also be surveyed.

References

Rooney-Latham, S. and Blomquist, C.L. 2014. First Report of Root and Stem Rot Caused by *Phytophthora tentaculata* on *Mimulus aurantiacus* in North America. *Plant Disease*. 98(7): 996-996.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS). 2010. *Phytophthora* species in the Environment and Nursery Settings New Pest Response Guidelines, USDA-APHIS-PPQ-Emergency and Domestic Programs-Emergency Management, Riverdale, Maryland. Pg. 247-248.

RESEARCH

Tooley, P.W.; Browning, M.; and Leighty, R.M. 2014. The Effect of Temperature on Germination of Chlamydospores of *Phytophthora ramorum*. *Mycologia*, 106(3): 424-430. DOI: 10.3852/13-313.

Abstract: Mycelium-free chlamydospores of 12 isolates of *P. ramorum* representing three clonal lineages were produced with a method involving incubation in nonsterile sand at 20 C in darkness for 30 d. Chlamydospores were incubated on selective agar medium at 5, 10, 15, 20, 25 and 30° C and germination assessed after 1, 2, 4, 6 and 8 d incubation. The optimal temperature for germination based on 8 d incubation was 20° C



for all three clonal lineages tested (NA1, NA2, EU1). Mean germination rates were 2, 21, 44, 67, 32 and 0 percent at 5, 10, 15, 20, 25 and 30° C respectively for all isolates combined. The highest mean germination rate was scored by isolates of the EU1 clonal lineage at 20° C (85%) after 8 d incubation. However, substantial variation was observed among isolates within each clonal lineage. Overall temperatures and days of incubation on which germination was assessed isolates of the NA1 clonal lineage had the lowest mean germination, even though one isolate had the highest germination of any isolate in any lineage. The results indicate that 20° C is the optimal germination temperature for *P. ramorum* chlamydospores and that a great disparity in germination percentage can exist within isolates, even within a single clonal lineage.

The following 6 abstracts on *P. ramorum* were presented at the 2014 APS Annual Meeting in Minneapolis, MN August 9th – 13th.

Aram, K. and Rizzo, D.M. 2014 Decaying Leaf Litter Supports *Phytophthora ramorum* and Endemic *Phytophthora* Species in Streams. 48-O.

Clement, D.L.; Malinoski, M.K.; Barger, C.T.; and McCarthy, R.L. 2014. Sentinel Plant Network Members in the Northeast and Mid-Atlantic Regions Use Smartphone App for Early Detection of Invasive Diseases and Insects. 648-P.

Conrad, A.O.; Rodriguez-Saona, L.; McPherson, B.; Wood, D.; and Bonello, P. 2014. New Approaches to Assess Coast Live Oak Resistance before Infection by the Invasive Pathogen *Phytophthora ramorum*. 19-S.

Knaus, B.J.; Fieland, V.J.; and Grünwald, N.J. 2014. Diversity of foliar *Phytophthora* species on Rhododendron in Oregon nurseries. 506-P.

Schweigkofler, W.; Kosta, K.; Huffman, V.; and Suslow, K. 2014. Thermal Inactivation of *Phytophthora ramorum* is a Management Option to Treat Infested Plants, Nursery Equipment, and Soil. 328-P.

Sharma, S.; Widmer, T.L.; Schweigkofler, W.; and Suslow, K. 2014. *In-vivo* Studies of the Interactions Between a GFP-Transformed *Trichoderma asperellum* Strain and *Phytophthora ramorum*. 154-P.

RELATED RESEARCH

Bilodeau, G.J.; Martin, F.N.; Coffey, M.D.; and Blomquist, C.L. 2014. Development of a Multiplex Assay for Genus- and Species-Specific Detection of *Phytophthora* Based on Differences in Mitochondrial Gene Order. *Phytopathology*. 104(7): 733-748.

Denman, S.; Brown, N.; Kirk, S.; Jeger, M.; and Webber, J. 2014. A Description of the Symptoms of Acute Oak Decline in Britain and a Comparative Review on Causes of Similar Disorders on Oak in Europe. *Forestry*. 0: 1–17. DOI:10.1093/forestry/cpu010.



Loyd, A.L.; Benson, D.M; and Ivors, K.L. 2014. *Phytophthora* Populations in Nursery Irrigation Water in Relationship to Pathogenicity and Infection Frequency of *Rhododendron* and *Pieris*. Plant Disease. 98(9): 1213-1220.

EDUCATION

An Urban Forest Insect and Disease Workshop will be offered to South Bay arborists September 30th from 9:45 a.m. to 3:00 p.m. in Woodside. Intended for arborists in San Mateo, Santa Clara, and Santa Cruz Counties, training objectives include improving diagnosis and management of urban forest pests, alerting arborists to be on the lookout for the polyphageous shot hole borer, and reviewing diagnosis and management of the goldspotted oak borer, SOD, pitch canker, other pests of concern. This workshop is being organized by the California Forest Pest Council in cooperation with the Western Chapter, International Society of Arboriculture; California Department of Forestry and Fire Protection, Urban Forestry; and USDA Forest Service, Pacific Southwest Research Station and Forest Health Protection. Registration is \$30 and includes indoor and outdoor sessions as well as lunch. CEUs are available. For more information, see the Calendar of Events below.

CALENDAR OF EVENTS

- 9/30 – Urban Forest Insect and Disease Workshop for South Bay Arborists;** Woodside; CEUs are available. For more information or to register, go to <http://caforestpestcouncil.org/2014/08/urban-forest-insect-and-disease-workshop-for-south-bay-arborists/>.
- 10/5 – 10/10 – IUFRO 2014 World Congress “Sustaining Forests, Sustaining People, The Role of Research;”** Salt Lake City, Utah; For more information or to register, go to <http://iufro2014.com/scientific-program/overview/>.
- 10/22 – 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 date for which you are registering. For more information, go to <http://nature.berkeley.edu/garbelotto/english/sodtreatmenttraining.php>.
- 11/3 – 11/6 - 7th California Oak Symposium: Managing Oak Woodlands in a Dynamic World; Visalia Convention Center, Visalia;** For more information, or to register, go to <http://ucanr.edu/sites/oaksymposium/>.
- 11/10 – 11/14 - Seventh meeting of the IUFRO Working Party 7.02.09 “Phytophthora in Forests and Natural Ecosystems;”** Esquel, Argentina. For more information, registration, or abstract submission details, go to <http://www.iufrophytophthora2012.org/>.
- 11/12 – 11/13 - 2014 Annual Meeting of the California Forest Pest Council; USDA Forest Service, Wildland Fire Training & Conference Center;** 3237 Peacekeeper Way; McClellan; More information will be forthcoming. For more information, contact Katie Palmieri at kpalmieri@berkeley.edu.
- 1/13/15-1/17/15 – California Native Plant Society Conservation Conference;**



“Celebrating 50 Years of Progress and Promise;” Hilton Double Tree; San Jose; 2050 Gateway Pl, San Jose; Early Registration is now open. For more information, go to <http://www.cnps.org/cnps/conservation/conference/2015>.