CALIFORNIA OAK MORTALITY TASK FORCE REPORT
OCTOBER 2022

Editor's Note. Please plan to join us at the virtual 2022 California Oak Mortality Task Force meeting, Nov. 8 – 10, 2022. The meeting is free and open to the public. For more details, please see the Calendar – Save the Date.

FOCUS ON MARIN COUNTY VEGETATION

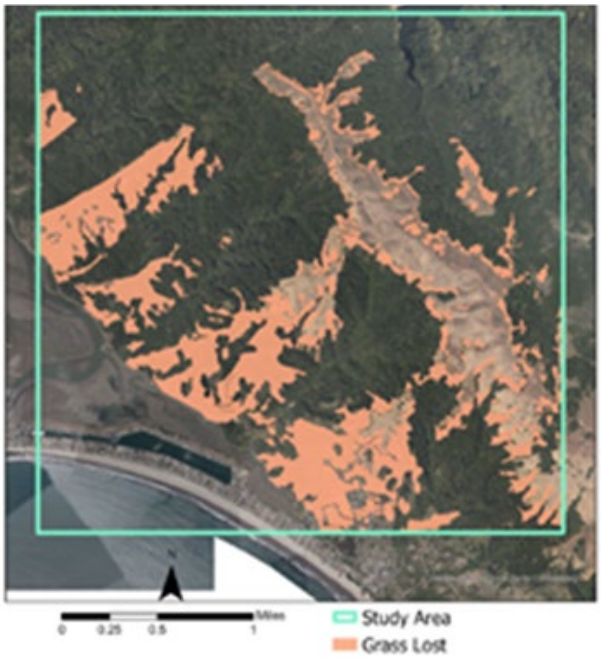

Figure 1. Reduction in grassland (shown in orange) along Bolinas Ridge, Marin Co. from 1952 to 2018. Image from Startin, 2022. M.S. thesis, USC.

Charlotte Startin, University of Southern California, assessed vegetation changes in Marin County from 1952-2018 by comparing historic and contemporary aerial imagery along Bolinas Ridge. Results show that over the past 70 years, grasslands and shrublands have shrunken in area by 62% and 51%, respectively, while woodlands have increased by over 300% (Fig. 1). The most common tree species replacing grass or shrub habitat were Douglas-fir, *Pseudotsuga menziesii* and California bay laurel, *Umbellularia californica.*

In 2018, the evaluation noted a lack of tanoak, *Notholithocarpus densiflorus*, but other trees and shrubs had established, especially Douglas-fir. Startin notes, "Tanoaks were not found to be part of the forest species gained, which may be attributed to the substantial loss of tanoaks in the 2000s. Without this die off, tanoaks may have been responsible for greater expansion of woodland species." The analysis concludes that lack of fire is driving tree encroachment. The methods and further details are presented in Startin's thesis.

Startin, C.R. 2022. Assessing woody plant encroachment in Marin County, California, 1952-2018. M.S. thesis, University of Southern California. https://spatial.usc.edu/wp-content/uploads/formidable/12/Charlotte-Startin-thesis.pdf.

The first-ever countywide fine scale vegetation maps and landscape databases for Marin and San Mateo Counties are now available. As part of the project**,** The Tamalpais Lands Collaborative (One Tam) produced canopy mortality maps which in Marin show significant mortality, mostly dead tanoak, along Bolinas Ridge due to sudden oak death, and on the Pt Reyes peninsula mortality due to pitch canker, *Fusarium circinatum* on Bishop pine (*Pinus muricata*), and Monterey pine (*Pinus radiata*) (Fig. 2).

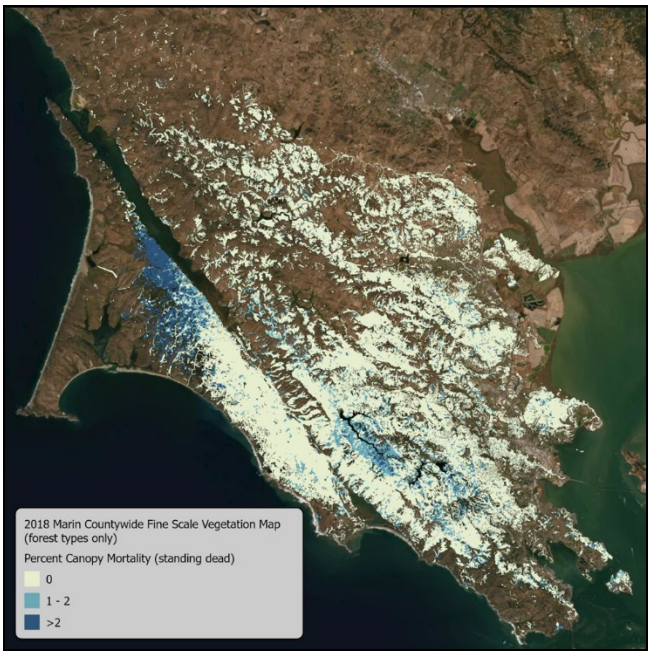

Figure 2. Percent canopy mortality from the 2018 Marin countywide fine scale vegetation map. The darker blue indicates more standing dead trees.

More information on "Canopy Mortality Mapping in Marin and San Mateo Counties" is available in a briefing paper by Danny Franco, Golden Gate National Parks Conservancy, or at PacificVegMap.org.

NURSERIES AND MANAGED LANDSCAPES

Louisiana Department of Agriculture and Forestry *P. ramorum* program update. Louisiana currently has one nursery under compliance for *P. ramorum* (previously positive in 2020). *P. ramorum* was not detected in the 2021 spring and fall compliance inspections. The 2022 spring compliance inspection resulted in six positive samples. A delimiting survey was completed in June with no additional positive samples found. The trace forward investigations within the state have been completed. One investigation resulted in three foliar samples being collected which all tested negative for *P. ramorum*. The fall compliance inspection is scheduled for the end of October. For additional information, contact the Louisiana Department of Agriculture and Forestry at horticulture@ldaf.state.la.us.

Oregon Department of Agriculture *P. ramorum* Nursery Program update. Currently, there are seven nurseries participating in the Oregon *P. ramorum* Nursery Program. Six of the nurseries are interstate shippers under federal compliance agreements (7 CFR 301.92). The

nurseries are in the following counties: Washington (2), Columbia (1), Linn (1) and Marion (2). One nursery is an intrastate retail nursery in Clackamas County under a state compliance agreement (both 7 CFR 301.92 and OAR 603-052-1230).

Trace-forward investigations sparked by a previous positive retail find in Marion County resulted in three additional positive retail nursery detections on plants from a Columbia County source nursery. One retail location was in Lincoln County, and two were in Multnomah County. At all three retail locations, commingled host plants near those sampled were discarded at the time of the trace forward inspection (Fig. 3).

Figure 3. *P. ramorum* positive rhododendron plant intercepted at a retail nursery in Multnomah County. Photo: Andriy Hos, ODA.

Fall compliance inspections will begin in October. To be released from the program, nurseries must have six consecutive negative results from semi-annual compliance inspections over three years. One nursery will be eligible to be released from the program this fall if negative results are found. For more information, please contact Chris Benemann, chris.benemann@oda.oregon.gov, or Kaitlin Gerber, kaitlin.gerber@oda.oregon.gov.

Washington Department of Agriculture, *P. ramorum* program update. The Washington State Department of Agriculture conducted two large trace-forward investigations during the summer. Many residential locations that received plants from out of state positive nurseries were inspected and sampled. In June, a trace-forward camellia was found positive at a residence in Pacific County. The soil under the plant was also found positive. The Confirmed Residential Protocol was enacted. Washington State University assisted by steaming the positive soil and determining the *P. ramorum* to be of the EU1 lineage.

The fall certification survey at Washington's only regulated interstate shipping nursery was conducted in late September. Results are pending. For more information contact Scott Brooks, SBrooks@agr.wa.gov.

RESEARCH

Davenport, B.; Neugebauer, K.; Harmon, C.; Luster, D.; Martin, F. and Miles, T. 2022. Optimization and evaluation of a robust confirmation tool for the detection of *Phytophthora ramorum* based on recombinase polymerase amplification. Poster. American Phytopathological Society conference, August 6 - 10, Pittsburgh, Pennsylvania.

Sudden oak death, caused by *Phytophthora ramorum*, is a detrimental disease with the potential to afflict mature native forests around the world. Routine screening and detection of *P. ramorum* from recognized and emerging hosts requires confirmatory diagnostics utilizing assays that can be hindered by sample inhibition, subsequently yielding inconclusive results. Recombinase polymerase amplification (RPA) has previously been employed in molecular diagnostics to circumvent inhibitory samples and simplify confirmatory testing through utilization of a crude sample preparation. An RPA assay specific to *P. ramorum* was previously developed that provided the specificity needed for confirmatory testing of *P. ramorum*, but the described internal control assay was limited in detection to only angiosperms. The developed *P. ramorum* assay was used here to multiplex with a new internal control capable of detecting a broader range of plant taxa. By multiplexing the *P. ramorum* RPA with an endogenous universal plant control assay and lyophilizing the reaction components into a 96 well dry bead plate, we believe that an RPA assay could be used for confirmatory testing of inconclusive samples in a high throughput setting. The lyophilized pellets were tested against the four lineages of *P. ramorum* and additional *Phytophthora* spp. from a variety of host plants. No cross-reactions to other *Phytophthora* spp. were observed. The duplexed assay under development would provide a simplistic approach to molecular confirmatory testing by simplifying sample preparation, harmonizing with existing diagnostic tools, and providing a means to screen difficult plant tissues where traditional molecular methods have shortcomings.

Dun, H.F.; Clarke, T.K.; Mackay, J.J. and Green, S. 2022. Exploring variation in susceptibility to *Phytophthora ramorum* in Japanese larch (*Larix kaempferi*). Forest Pathology. e12759. https://doi.org/10.1111/efp.12759.

Phytophthora ramorum is an invasive pathogen responsible for extensive mortality in larches in the United Kingdom. There is great interest from the forestry industry in the possibility of selection for resistance to *P. ramorum* in Japanese larch in order to retain it as a commercially viable species. This study is the first to investigate variation in resistance to *P. ramorum* among planted populations of Japanese larch in the UK. Our study uses inoculation of excised material from putatively resistant survivor trees and known susceptible trees. We found variation in susceptibility to *P. ramorum* within Japanese larch stands planted in the Galloway forest of Scotland with some trees showing significantly shorter lesion development than others, from a mean lesion length of 34.7 mm in the least susceptible clone to 135 mm in the most susceptible. Although clones from the putatively resistant and known susceptible groups were not significantly different ($p = .055$), we propose that survivor trees include a higher proportion of resistant or low susceptibility trees and would be a useful starting point for further work investigating natural resistance in larch.

Pintos-Varela, C.; Rial-Martínez, C.; Piñon Esteban, P.; Salinero-Corral, C. and Aguín-Casal, O. 2022. Occurrence of *Phytophthora ramorum* and other *Phytophthora* species on woody ornamentals in public gardens and parks in northwestern Spain. Plant Health Progress. First look. https://doi.org/10.1094/PHP-01-22-0008-RS.

Figure 4. *P. ramorum* symptoms on *Viburnum tinus* as shown in Pintos-Varela et al. 2022.

Phytophthora ramorum is a harmful pathogen of ornamental and forest trees in Europe and North America. This pathogen has been recovered from nursery plants in Galicia (northwestern Spain) beginning in 2003 and despite carrying out the measures implemented by Commission Decision 2002/757/CE, among which are the eradication of infected plants and periodic inspections in nurseries, it is likely that *P. ramorum* has spread in landscaped green areas through planting of infected nursery stock. The aim of this work was to survey woody ornamental plants growing in public parks and gardens in Galicia for the presence of *P. ramorum* during 2011-2018 and, also to identify and characterize any other species of the genus found. Samples of leaves, twigs, and rhizosphere soil of symptomatic ornamental trees and shrubs were analyzed. Morphological, physiological, and molecular characteristics of 93 collected isolates enabled the identification of 13 species of *Phytophthora*. The greatest diversity of *Phytophthora* species was detected on *Rhododendron* and *Camellia*. *Phytophthora ramorum* was isolated from leaf samples of *Camellia* sp., *Rhododendron* sp., and *Viburnum tinus* grown in three sites. To our knowledge, this is the first time that *P. ramorum* has been detected in landscaped green areas in Spain (Fig. 4) . These results suggest that regular inspections of symptomatic ornamental woody plants are necessary to control the spread of *P. ramorum* and other *Phytophthora* species.

RELATED RESEARCH

Abad, Z.G., Burgess, T., Redford, A.J., Bienapfl, J.C., Mathew, R., Srivastava, S.K. and Jennings, K.C. 2022. IDphy: An international online resource for molecular and morphological identification of *Phytophthora*. Plant Disease. First Look. https://doi.org/10.1094/PDIS-02-22-0448-FE.

Chen, Q.; Bakhshi, M.; Balci, Y. and others. 2022. Genera of phytopathogenic fungi: GOPHY 4. Studies in Mycology. 101: 417–564. https://doi.org/10.3114/sim.2022.101.06.

Hunter, S.; McDougal, R. L.; Williams, N. and Scott, P. 2022. Evidence of phosphite tolerance in *Phytophthora cinnamomi* from New Zealand avocado orchards. Plant Disease. First Look. https://doi.org/10.1094/PDIS-05-22-1269-RE.

Jung, T.; Milenković, I.; Corcobado, T. and others. 2022. Extensive morphological and behavioural diversity among fourteen new and seven described species in *Phytophthora* Clade 10

and its evolutionary implications. Persoonia 49: 1– 57. https://doi.org/10.3767/persoonia.2022.49.01.

Mora-Sala, B.; León, M.; Pérez-Sierra, A. and Abad-Campos, P. 2022. New reports of *Phytophthora* species in plant nurseries in Spain. Pathogens. 11(8): 826. https://doi.org/10.3390/pathogens11080826.

EDUCATION AND OUTREACH

Solano, A.; Rodriguez, S.L; Greenwood, L.; Rosopa, P.J. and Coyle, D.R. 2022. Achieving effective outreach for invasive species: firewood case studies from 2005 to 2016. Biological Invasions. 1-19. https://link.springer.com/article/10.1007/s10530-022-02848-w.

Solano et al. present results from public opinion polls that gauged general awareness and attitudes concerning invasive forest pests and effective delivery of information. Their findings are based on several surveys conducted nationally and regionally between 2005 and 2016. Overall, awareness regarding invasive forest pests was low among participants. For *P. ramorum*/sudden oak death, 72% had not heard of the pathogen or disease. For comparison, chestnut blight was also included in the survey and 71% had not heard of that tree disease.

CALENDAR – SAVE THE DATE

November 8 – 10, 2022. The 2022 annual meeting of the California Oak Mortality Task Force will be held online, November 8 – 10, 2022 at various times each day. There is no registration fee – the meetings are free and open to the public. Day 1 - Nov. 8th, 10 am to 12 noon (PST) will feature science and international *Phytophthora* updates; Day 2 - Nov. 9th from 1 pm to 3 pm, highlights sudden oak death status in Oregon and California; and Day 3 - Nov. 10th from 1 pm to 3:30 pm, organized by the Phytophthoras in Native Habitats Work Group, will focus on pathogens in restoration sites and native plant nurseries. Registration and the complete agenda are now available. For questions, contact Janice Alexander, jalexander@ucanr.edu.

November 16 -17, 2022. The 2022 annual meeting of the California Forest Pest Council will be held November 16-17, 2022 in a hybrid format: in-person at the UC Davis, Student Community Center Multipurpose Room or virtual**.** "The Dynamics of California Forest Pests: from Hand Lens to Landscape" will feature updates on tree mortality trends, forest insect and pathogen activity, and how these issues are being addressed. More information and registration are pending at https://www.caforestpestcouncil.org/events, or contact Kim Corella, Kim.Corella@fire.ca.gov.