CALIFORNIA OAK MORTALITY TASK FORCE REPORT
SEPTEMBER 2013

RESEARCH

Coast redwoods are nearly four times more likely to die during forest fires in SOD-infested forests than in non-infested forests, according to a recent study conducted by UC Davis researchers.

Since 2006, the UC Davis Rizzo lab and colleagues have been monitoring 280 field plots over nearly 200,000 acres in the Big Sur region of California. The plots encompass several forest types that are susceptible to invasion by *Phytophthora ramorum* (mixed-evergreen, redwood). In 2008, wildfires burned almost half of the plots in the study area. The Basin Complex fire burned more than 234,000 acres in June, and the Chalk Fire burned an additional 16,000 acres south of the Basin Complex in September. In 2009, one year after the fires, 46 burned redwood plots were re-surveyed (23 each infested and uninfested). Every live or dead stem that was identified, mapped, measured, and assessed for pathogen infection upon plot establishment in 2006–2007 was reassessed for survival in 2009. For 29 of these plots tree level indicators of burn severity (e.g., stem char height, percent crown scorch, and changes to soil structure) were collected immediately following the Basin Fire from September through October 2008. Findings indicate that tanoak killed by sudden oak death result in more fuel for wildfires as well as decreased moisture levels in affected forests as shade diminishes in the absence of trees. These dynamics make SOD-infested forests dryer and allow flames to travel into the canopy by way of the standing dead tanoaks, allowing fire to scorch nearby redwood crowns and leading to redwood die-off rates nearly four times those of the healthy plots that burned.

Funding for this research was provided by the National Science Foundation and National Institute of Health Ecology and Evolution of Infectious Diseases Program, the USDA Forest Service Pacific Southwest Research Station and State & Private Forestry, and the Gordon & Betty Moore Foundation. The results appear in: Metz, M.R.; Varner, J.M.; Frangioso, K.M.; Meentemeyer, R.K.; and Rizzo, D.M. *In press*. Unexpected Redwood Mortality from Synergies Between Wildfire and an Emerging Infectious Disease. Ecology. http://dx.doi.org/10.1890/13-0915.1. For more information, contact Dave Rizzo at dmrizzo@ucdavis.edu.

Frankel, S.J.; Kliejunas, J.T.; Palmieri, K.M.; and Alexander, J.M. tech. coords. 2013. Proceedings of the Sudden Oak Death Fifth Science Symposium. Gen. Tech. Rep. PSW-GTR-243. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 169 p. Available online at http://www.fs.fed.us/psw/publications/documents/psw_gtr243/. For a free copy, email rschneider@fs.fed.us with your name and address, and include "PSW-GTR-243" in the subject line.

Tanoak: History, Ecology and Values. Madroño 60(2): 62-164. 2013. Includes papers presented at “Tanoak Wild: A Celebration,” June 22, 2012, as part of the Fifth Sudden

Oak Death Science Symposium. 2013. The issue is available at http://www.calbotsoc.org/special_issues.html.

Hayden, K.J.; Garbelotto, M.; Dodd, R.; and Wright, J.W. 2013. Scaling up from Greenhouse Resistance to Fitness in the Field for a Host of an Emerging Forest Disease. Evolutionary Applications. DOI: 10.1111/eva.12080.

Abstract: Forest systems are increasingly threatened by emergent, exotic diseases, yet management strategies for forest trees may be hindered by long generation times and scant background knowledge. We tested whether nursery disease resistance and growth traits have predictive value for the conservation of *Notholithocarpus densiflorus*, the host most susceptible to sudden oak death. We established three experimental populations to assess nursery growth and resistance to *Phytophthora ramorum*, and correlations between nursery-derived breeding values with seedling survival in a field disease trial. Estimates of nursery traits' heritability were low to moderate, with lowest estimates for resistance traits. Within the field trial, survival likelihood was increased in larger seedlings and decreased with the development of disease symptoms. The seed-parent family wide likelihood of survival was likewise correlated with family predictors for size and resistance to disease in 2nd year laboratory assays, though not resistance in 1st year leaf assays. We identified traits and seedling families with increased survivorship in planted tanoaks, and a framework to further identify seed parents favored for restoration. The additive genetic variation and seedling disease dynamics we describe hold promise to refine current disease models and expand the understanding of evolutionary dynamics of emergent infectious diseases in highly susceptible hosts.

Osterbauer, N.K.; Lewis, S.; Hedberg, J.; and McAninch, G. 2013. Assessing Potential Hazards for *Phytophthora ramorum* Establishment in Oregon Nurseries. J. Environmental Horticulture. 31(3):133–137.

Abstract: In 2011 and 2012, nurseries that ship plants interstate were surveyed for hazardous conditions that may contribute to *Phytophthora ramorum* establishment within plant production areas. Four-hundred-forty-three nurseries were surveyed for issues related to irrigation water, soil drainage, general sanitation, handling of potting media, potting practices, and the surface on which containerized plants were placed. While most nurseries used best management practices to address those potential hazards, potentially risky conditions were observed at several nurseries. Seventy-nine nurseries used untreated water from rivers and ponds to irrigate their plants. One hundred-thirteen nurseries had standing water present in greenhouses and/or in plant production areas. Heavy amounts of plant debris were observed in 39 nurseries, while 36 nurseries placed cull piles in risky locations. One-hundred-thirteen nurseries placed containerized plants on native soil and 157 nurseries stored potting media on native soil. Re-using pots was a common practice, although 207 nurseries did not clean or sanitize containers before re-use. Adopting or changing management practices to address these hazardous conditions would help mitigate the risk of *P. ramorum* becoming established in the nurseries.

Shrestha, S.K.; Zhou, Y.; and Lamour, K.H. 2013. Oomycetes baited from streams in Tennessee 2010-2012. Mycologia 13-010. Available online at http://www.mycologia.org/cgi/content/abstract/13-010v1

Abstract: Sixteen streams in middle and eastern Tennessee were surveyed for the sudden oak death pathogen *Phytophthora ramorum* 2010-2012. Surveys were conducted in the spring and fall using healthy Rhododendron leaves and a total of 354 oomycete isolates were recovered. Sequence analysis of the ITS region provisionally identified 151 *Phytophthora*, 200 *Pythium*, 2 *Halophytophthora* and 1 *Phytopythium*. These include six *Phytophthora* species (*P. cryptogea*, *P. hydropathica*, *P. irrigata*, *P. gonapodyides*, *P. lacustris* and *P. polonica*), members of the *P. citricola* species complex, five unknown *Phytophthora* species, eleven *Pythium* species (*P. helicoides*, *P. diclinum*, *P. litorale*, *P. senticosum*, *P. undulatum*, *P. vexans*, *P. citrinum*, *P. apleroticum*, *P. chamaihyphon*, *P. montanum* and *P. pyrilobum*), three unknown *Pythium* species, *Halophytophthora batemanensis*, and one *Phytopythium* isolate. The biology and implications are discussed.

MONITORING

***Phytophthora ramorum* continues to spread on Japanese larch (*Larix kaempferi*) in** Wales according to 2013 summer surveys. Initial results indicate that nearly 4,450 acres of new infection have been identified and includes further areas within South Wales that were not previously not known to be infested. Ground surveys are underway to confirm the findings.

P. ramorum was first discovered in Wales in the Afan Valley in 2010. By the end of 2012, Japanese larch trees on more than 7,400 acres had been infested. To date, approximately 3,210 acres of larch trees, which form an important part of Wales' commercial forests, have been felled in an effort to contain the pathogen. It's believed current disease spread is a result of weather patterns, as 2012 was one of the wettest summers on record for Wales and was followed by a mild start to winter.

Infected larch have been found in all four UK countries as well as the Republic of Ireland. Since 2009, approximately 8.5 million infested Japanese larch trees over nearly 22,000 acres (England - 6,300; Scotland - 1,120; Wales - 12,445; Northern Ireland - 1,567) have been, or are in the process of being, felled in the United Kingdom in an effort to contain pathogen spread.

NURSERIES

***Phytophthora ramorum* was detected infecting a *Parrotia persica* (Persian ironwood)** plant in a Multnomah County, Oregon nursery during an annual compliance survey. This nursery was previously positive in 2010. The USDA Confirmed Nursery Protocol has been enacted and delimitation surveys are underway. This is the 10th Oregon nursery location to test positive for *P. ramorum* in 2013.

REGULATIONS

The USDA Animal and Plant Health Inspection Service (APHIS) and the Canadian Food Inspection Agency (CFIA) are seeking feedback from stakeholders on the draft Canada-United States Perimeter Approach to Plant Protection framework, which proposes details on how the two agencies can work together on regulations and alignment of policies where possible for safe and efficient plant and plant product trade between Canada and US. A copy of the work plan is available online at http://www.trade.gov/RCC/documents/Perimeter-Approach-to-Plant-Protection.pdf. Plant health stakeholder feedback on the proposed framework, the role of stakeholders in the process, and issues that could benefit from closer US-Canada regulatory cooperation is desired. Comments must be submitted by September 27, 2013 to APHIS at RCCPlantProtection@aphis.usda.gov.

RELATED RESEARCH

Scanu, B.; Hunter, G.C.; Linaldeddu, B.T.; Franceschini, A.; Maddau, L.; Jung, T.; and Denman, S. 2013. A Taxonomic Re-evaluation Reveals that *Phytophthora cinnamomi* and *P. cinnamomi* var. *parvispora* are separate species. Forest Pathology. DOI: 10.1111/efp.12064.

Between 2008 and 2011, severe dieback associated with root and collar rot was reported on *Arbutus unedo* in several sites in Sardinia, Italy. Isolations from infected tissues and rhizosphere soil samples consistently yielded a *Phytophthora* species. It was initially identified as *Phytophthora cinnamomi* var. *parvispora* Kröber and Marwitz by comparing morphological features with the original description and the internal transcribed spacer (ITS) sequences with those present in GenBank. A multigene phylogeny based on DNA sequence data from two nuclear (ITS and β-tubulin) and two mitochondrial (cox1 and cox2) gene regions combined with extensive morphological and physiological properties of these isolates, including the ex-type culture of *P. cinnamomi* var. *parvispora*, demonstrates that this taxon is unique and it is redesignated here as *Phytophthora parvispora* sp. nov. Although morphologically similar to *P. cinnamomi*, *P. parvispora* differs by its smaller-sized sporangia, chlamydospores, oogonia and oospores, higher oospore wall index, single-celled antheridia, higher minimum and maximum temperatures for growth and faster growth at optimum temperature. In the phylogeny, *P. parvispora* falls within *Phytophthora* ITS clade 7a, grouped in a well-supported clade sister to *P. cinnamomi*. In pathogenicity tests, *P. parvispora* and *P. cinnamomi* were equally aggressive towards *A. unedo* seedlings. The possible geographic origin of *P. parvispora* is also discussed.

EDUCATION AND OUTREACH

Highlights from the spring 2013 SOD Blitz will be presented simultaneously to live and remote audiences on Thursday, October 3, 2013. The UC Berkeley live presentation will be webcast to participating SOD Blitz communities in an effort to bring everyone working on this issue together under one virtual roof. Attendees will be provided with findings from the first 5 years of blitzes, which shows that data collected by volunteers increases SOD infection predictability, as well as receive a demonstration on how to use

new Apps developed for SOD (SODMAP mobile for iPhone and for Droid). More information on the blitz results meeting will be forthcoming at http://nature.berkeley.edu/garbelotto/english/sodblitzfollowup.php.

A webinar series on irrigation pathogens and recycled water quality is being offered through Virginia Tech from 10/8/13 – 11/4/13. The latest research will be presented on issues surrounding crop health, agricultural water security, and our environmental footprint. For a schedule of the webinar classes as well as information on how to connect to the sessions, go to http://www.irrigation-pathogens.ppws.vt.edu/webinar/index.php. All webinar sessions will be held from 12:00 noon to 1:00 pm Eastern Time and can be accessed at https://connect.extension.iastate.edu/irrigation-water/.

This project is sponsored through the Specialty Crop Research Initiative of USDA National Institute of Food and Agriculture. It is a partnership between seven institutions and the ornamental horticultural industry in pursuit of better plant quality and productivity while promoting containment and recycling of irrigation water to protect and conserve natural water resources.

CALENDAR OF EVENTS

10/3 - SOD-Blitz Spring 2013 Results Live Webcast; For more information, see "Education and Outreach" above or go to http://nature.berkeley.edu/garbelotto/english/sodblitzfollowup.php, where more information will be forthcoming on meeting details.

10/12 – Humboldt County Sudden Oak Death (SOD) Blitz; Azalea Hall Meeting Room; 1620 Pickett Road, McKinleyville; 10:00 a.m. – 12:00 p.m. The Blitz is intended to help community members identify locations where SOD is present as well as increase local awareness of the issue. Those planning to attend are encouraged to bring a GPS unit if they have one. For more information, contact Dan Stark at (707) 445-7351 or stark@ucanr.edu.

10/23 - 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, 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.

11/4 – 11/5 – Annual meeting of the Continental Dialogue on Non-Native Forest Insects and Diseases; Pittsburgh Convention Center; Pittsburgh, Pennsylvania; For more information, go to http://www.continentalforestdialogue.org/events/dialogue/2013-11-04/index.html.

11/10 – 11/14/14 - 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/.