CALIFORNIA OAK MORTALITY TASK FORCE REPORT
SEPTEMBER 2010

MONITORING

***P. ramorum*-infected Japanese larch has been confirmed for the first time in** northern Wales. The private woodland owner will be removing the infected trees per Forestry Commission Wales and FERA notification, and the remaining timber will be used on site.

Confirmation through isolation continues to be difficult (success rate of 10 – 35 percent) for larch, and has likely been complicated by the dry spring and early summer in Britain which may have slowed *P. ramorum* growth in conifer bark. Aerial surveys along with follow-up ground checks and sampling are continuing throughout Wales.

***P. ramorum*-infected Japanese larch trees have been found in Ireland for the first** time. Three of the infested areas are in Northern Ireland where extensive dieback and mortality are occurring. The Republic of Ireland also confirmed *P. ramorum*-positive Japanese larch in southern Ireland in an area where the pathogen had previously been found on rhododendron.

Japanese larch trees represent approximately three percent of the total forest tree population in Ireland. Prior to these finds, *P. ramorum* had only been found on *Rhododendron* and other ornamental species at sites which included plant production/retail premises, private gardens, private estates, and public parks. Japanese larch on both public and private land will be felled in an effort to contain the outbreaks and bio-security measures are being put in place. Forest visitors are being asked to stay on forest roads, keep dogs on leashes, and remove soil and mud from shoes and boots before leaving infested woodlands.

Aerial and ground surveys in England continue to identify more suspect *P. ramorum* sites, and the number of locations with positive larch is increasing. Although most of the affected trees are still in the western region of the country (Cornwall, Devon, and Somerset), affected sites are now being found further east, into Wiltshire.

Washington has identified a Kitsap Peninsula creek *P. ramorum* water positive further downstream than previous detections. This creek is associated with a Peninsula nursery that has been free from the pathogen for several years following implementation of the Confirmed Nursery Protocol; however, the brackish creek water continues to be *P. ramorum* positive.

NURSERIES

Following the retirement of the California Association of Nurseries and Garden Centers (CANGC) President Elaine Thompson, the Association's Board of Directors chose to move their leadership under the umbrella of the California Grain and Feed Association (CGFA) and the CGFA Executive Vice President Chris Zanobini, who will

serve as CANGC's new president. The Board of Directors will be working with Zanobini to develop strategic planning as well as insure that nursery industry concerns in California are addressed. CGFA offers service management to over 20 other associations such as the California Seed Association and the California State Floral Association. Sharing resources and overhead with other organizations will allow CANGC to provide a high level of membership value, utilize its finances more efficiently, and receive the highest level of service. For more information, contact David Cox, CANGC Vice Chair, at dhcox@lecooke.com or Chris Zanobini, CANGC President, at chris@cgfa.org.

A *P. ramorum*-positive planted *Camellia sasanqua* was confirmed in a Stanislaus County residential subdivision on 8/31 following a trace-forward investigation from a Stanislaus nursery (confirmed 6/10). Per the Potentially Actionable Suspect Sample System, Stanislaus County officials will begin implementing the Residential and Landscaped Commercial Settings Protocol immediately.

A Pierce County, Washington retail nursery was found to have three *P. ramorum*-positive rhododendron plants on 8/27 during a follow-up inspection of the retailer who completed the CNP in May. The nursery has elected to destroy all affected host plants rather than establish a 90-day hold quarantined block because they are going out of business at the end of September. This site has been positive in previous years.

The Washington State Department of Agriculture has completed recertification of approximately 300 host and non-host shippers. It is anticipated that the remaining recertifications will be completed in September.

In August, the Oregon Department of Agriculture began conducting high-risk surveys within those nurseries that ship *Rhododendron* and/or *Camellia* interstate. So far, nine nurseries have been surveyed with 157 samples collected for testing. No *P. ramorum* has been detected.

The Canadian Food Inspection Agency (CFIA) has almost completed its 2010 national survey for *P. ramorum*. Of the 133 nurseries sampled throughout Canada, *P. ramorum* has been detected at five retail nurseries and two propagation nurseries in urban areas of southwest British Columbia. Five of the nurseries also tested positive for the pathogen in 2008 or 2009. The infested material at each site has been deep buried or incinerated under CFIA supervision. Follow-up sampling of plants, soil, and water is underway at each location. The infected plants included *Rhododendron*, *Pieris*, *Camellia*, *Kalmia*, hybrid witch hazel (*Hammemalis* x *intermedia*), and drooping leucothoe (*Leucothoe fontanesiana*).

REGULATIONS

The USDA Animal and Plant Health Inspection Service (APHIS) is soliciting for public comments under the paper work reduction act of 1995. The APHIS Notice is to Request for Extension of Information Collection for *Phytophthora ramorum*; Quarantine and Regulations. The regulations contain requirements for the interstate movement of

regulated articles, such as nursery stock and certain trees, from both quarantined and non-quarantined areas and involve information collection activities, including certificates, compliance agreements, and recordkeeping. APHIS is requesting the Office of Management and Budget to approve the use of these information collection activities for an additional 3 years.

Florida has implemented a new rule regulating firewood (Chapter 5B-65). The intent of the rules is to prevent the introduction of wood boring pests, wood inhabiting pests, and plant pathogens (including *P. ramorum*) into the state, and to prevent the spread of pests within the state by regulating the movement of firewood and unprocessed wood products that can harbor wood boring and wood inhabiting pests and pathogens.

CFIA national *P. ramorum* program changes - As Shane Sela takes on a greater role within the Canadian national Forestry Program, *P. ramorum* leadership will transfer to John McDonald in the Horticulture Division who has been an integral part of the program since 2005. Shane will continue to participate in *P. ramorum* issues as they relate to the CFIA Forestry Division. John can be contacted at (613) 773-7178 or John.G.McDonald@inspection.gc.ca.

MANAGEMENT

The new fungicide Adorn™ has been registered for use in California (EPA Reg. No. 59639-141) against *P. ramorum*. The product is intended for ornamental use only and can be applied to foliage or as a soil drench. The active ingredient fluopicolide has been proven to be effective on other *Phytophthoras*, and must be tank-mixed with another product (such as a mefenoxam) for fungicide resistance management. This pesticide has a "caution" label and is toxic to fish and aquatic invertebrates. Follow label directions: http://www.valent.com/professional/products/adorn/label-msds.cfm.

The United Kingdom's Pro-Art Signs Swansea Bay Rally has been postponed due to the presence of *P. ramorum* along sections of the raceway. Following a meeting with Forestry Commission representatives to discuss the infested exclusion zones, race officials decided the quality of the race would be compromised if held given the required route changes. More information is posted at http://www.swanseabayrally.com/.

RESEARCH

***P. ramorum* has recently been isolated from a bole canker on a mature canyon live** oak (*Quercus chrysolepis)*. This first culture isolation, by Elizabeth Bernhardt and Ted Swiecki of Phytosphere Research working in collaboration with the Rizzo UC Davis lab, complements previously reported PCR detections, lab inoculations, and epidemiological data showing that canyon live oak is susceptible to lethal bole cankers (9/09 COMTF newsletter). The isolation was obtained from a canyon live oak in San Mateo County located on one of the Midpeninsula Regional Open Space District (MROSD) preserves near Skyline Drive (SR35). Stands of intermixed canyon live oak and California bay laurel occur in a number of MROSD preserves in this area where many large mature canyon live oaks have died over the past few years. View Canyon Live Oak photos.

Although the positive isolation was obtained from a small canker with little bleeding, field observations suggest that many *P. ramorum*-infected canyon live oak may not bleed, or that bleeding may only occur for a short time. Furthermore, the rate and sequence of symptom development in affected canyon live oak is unknown. With funding from the USDA Forest Service's Forest Health Protection Program, and MROSD, further work will study canyon live oak's susceptibility to *P. ramorum*.

Additional information on symptom development will be obtained from a field inoculation study initiated in this July. Eighteen canyon live oaks on a MROSD preserve were inoculated with local isolates of *P. ramorum*. Protocols used were the same as those used by the Rizzo lab in the initial susceptibility tests of coast live oak and tanoak in 2000 at Mt. Tamalpais. Development of external symptoms will be monitored by researchers and trained MROSD staff members over the next year or more. For more information, contact Ted Swiecki at phytosphere@phytosphere.com.

Brasier, C. and Webber, J. 2010. Plant pathology: Sudden larch death. Nature, 466, 824-825. DOI: 10.1038/466824a.

Summary: An aggressive and unpredictable fungal pathogen is devastating larch plantations in Britain. Its remarkably broad host range and the possibility of further geographical spread give heightened cause for concern. For more than a decade, a stream of invasive tree pathogens has been arriving in Europe and North America. Among the more damaging and unpredictable arrivals is *Phytophthora ramorum*.

Chastagner, G.A. and Riley, K.L. 2010. Disease Notes: First Report of *Phytophthora ramorum* Infecting California Red Fir in California. Plant Disease, Volume 94, Number 9, Page 1170. DOI: 10.1094/PDIS-94-9-1170B.

Abstract: In May 2005, branches originating from five separate whorls below the terminal on a single California red fir (*Abies magnifica*) in a mixed grand fir (*Abies grandis*) and Douglas-fir (*Pseudotsuga menziesii*) Christmas tree plantation near Los Gatos, CA displayed wilting and dieback of new shoot growth. Brown dieback, delineated by needle loss, extended 6 to 8 cm into 1-year-old and sometimes 2-year-old growth. The ~7-year-old, 1-m tall tree was located near the edge of the plantation, beneath an overstory of California bay laurel (*Umbellularia californica*) trees that were infected with *Phytophthora ramorum*. Isolations from dieback margins onto corn meal agar amended with ampicillin, rifamycin, and pimaricin (CARP) yielded hyphae and large, dark brown chlamydospores that were morphologically consistent with *P. ramorum* (1). Microsatellite analysis confirmed that isolates were of the NA1 lineage of *P. ramorum*. Isolates were deposited in the Washington State University Puyallup *Phytophthora* Master Collection. Dormant bareroot California red fir seedlings were obtained from the USDA Forest Service Placerville Nursery (Camino, CA) in February 2006 and planted in SC-10 super cell cones (Stuewe & Sons, Inc., Tangent, OR) in a standard greenhouse potting mix. Seedlings (average height 11 cm) were then forced to

initiate bud break and new shoot elongation (0.5 to 1.5 cm) in a greenhouse at 21°C. Eight unwounded seedlings were inoculated with a zoospore suspension (4.185×10^5 zoospores/ml of sterile water) produced from 3- to 4-week-old V8 juice agar cultures of isolate WSU#106-0021 using an artist's airbrush powered by Badger Propel canned propellant. Eight control seedlings were sprayed with water alone. Seedlings were placed in plastic tubs with ~2.5 cm of warm water in the bottom to provide humidity. A plastic bag supported by a wire frame was used to cover each tub. Tubs were placed in a biocontainment unit at 15 to 16°C under 24 h of fluorescent light. The plastic was removed after 5 days and seedlings were left under the same conditions. Seven days after inoculation, 25 to 100% (average 68%) of the new shoots on each of the eight inoculated seedlings were wilted and 100% of these seedlings exhibited dark brown dieback into the 1-year-old stems (range of 1.0 to 2.3 cm, average 1.6 cm). Tissues from shoots and dieback edges were plated onto CARP media. All of these attempts resulted in successful isolation of *P. ramorum*, and cultures exhibited the same hyphal morphology and chlamydospore characteristics when compared with the isolate tested. Control plants did not develop symptoms. This trial completes Koch's postulates to establish California red fir as a host of *Phytophthora ramorum*. To our knowledge, this site contains the only reported infection of California red fir by *P. ramorum*. The potential for infection within its native range is unknown.

Ellis, A.; Vaclavik, T.; and Meentemeyer, R.K. 2010. When is connectivity important? A case study of the spatial pattern of sudden oak death. Oikos, 119(3): 485-493.

Abstract: Although connectivity has been examined from many different angles and in many ecological disciplines, few studies have tested in which systems and under what conditions connectivity is important in determining ecological dynamics. Identifying general rules governing when connectivity is important is crucial not only for basic ecology, but also for our ability to manage natural systems, particularly as increasing fragmentation may change the degree to which connectivity influences ecological dynamics.

In this study, we used statistical regression, least-cost path analysis, and model selection techniques to test the relative importance of potential connectivity in determining the spatial pattern of sudden oak death, a tree disease that is killing millions of oak and tanoak trees along coastal forests of California and Oregon. We hypothesized that potential connectivity, in addition to environmental conditions, is important in determining the spatial distribution of sudden oak death, the importance of connectivity is more apparent when measured using biologically meaningful metrics that account for the effects of landscape structure on disease spread, and the relative importance of environmental variables and connectivity is approximately equal.

Results demonstrate that potential connectivity was important in determining the spatial pattern of sudden oak death, though it was relatively less important than environmental variables. Moreover, connectivity was important only when using biologically

meaningful metrics as opposed to simple distance-based metrics that ignore landscape structure. These results demonstrate that connectivity can be important in systems not typically considered in connectivity studies – highlighting the importance of examining connectivity in a variety of different systems – and demonstrate that the manner in which connectivity is measured may govern our ability to detect its importance.

Ramage, B.S. and O'Hara, K.L. 2010. Sudden Oak Death-Induced Tanoak Mortality in Coast Redwood Forests: Current and Predicted Impacts to Stand Structure. Forests, 1(3), 114-130. DOI: 10.3390/f1030114.

Abstract: Tanoak (*Notholithocarpus densiflorus* syn. *Lithocarpus densiflorus*) is one of the most widespread and abundant associates of coast redwood (*Sequoia sempervirens*), but little is known about the structural relationships between these two species. Knowledge of such relationships is essential for a thorough understanding of the impacts of sudden oak death (caused by the exotic pathogen *Phytophthora ramorum*), which is currently decimating tanoak populations throughout the redwood range. In this study, we utilized a stratified plot design and a stand reconstruction technique to assess structural impacts, at present and in the future, of this emerging disease. We found that residual trees in diseased plots were more aggregated than trees in unaffected plots, and we predicted that the loss of tanoak will lead to the following short-term changes: greater average diameter, height, height-to-live-crown, and crown length, as well as an increase in average nearest neighbor differences for diameter, height, and crown length. In addition, plots lacking tanoak (living or dead)—as compared to plots with tanoak—exhibited greater average diameter and increased nearest neighbor differences with regard to diameter, height, and crown length. We also conducted a preliminary exploration of how sudden oak death-induced structural changes compare with typical old-growth characteristics, and how this disease may affect the structure of old-growth forests.

Vaclavik, T.; Kanaskie, A.; Hansen, E.M.; Ohmann, J.L.; and Meentemeyer, R.K. 2010. Predicting potential and actual distribution of sudden oak death in Oregon: Prioritizing landscape contexts for early detection and eradication of disease outbreaks. Forest Ecology and Management, Volume 260, Issue 6, Pages 1026-1035. DOI: 10.1016/j.foreco.2010.06.026.

Abstract: An isolated outbreak of the emerging forest disease sudden oak death was discovered in Oregon forests in 2001. Despite considerable control efforts, disease continues to spread from the introduction site due to slow and incomplete detection and eradication. Annual field surveys and laboratory tests between 2001 and 2009 confirmed a total of 802 infested locations. Here, we apply two invasive species distribution models (iSDMs) of sudden oak death establishment and spread risk to target early detection and control further disease spread in Oregon forests. The goal was to develop (1) a model of *potential distribution* that estimates the level and spatial variability of disease establishment and spread risk for western Oregon, and (2) a model of *actual distribution* that quantifies the relative likelihood of current invasion in the quarantine area. Our predictions were based on four groups of primary parameters that vary in space and time:

climate conditions, topographical factors, abundance and susceptibility of host vegetation, and dispersal pressure. First, we used multi-criteria evaluation to identify large-scale areas at potential risk of infection. We mapped and ranked host abundance and susceptibility using geospatial vegetation data developed with gradient nearest neighbor imputation. The host vegetation and climate variables were parameterized in accordance to their epidemiological importance and the final appraisal scores were summarized by month to represent a cumulative spread risk index, standardized as five categories from very low to very high risk. Second, using the field data for calibration we applied the machine-learning method, maximum entropy, to predict the actual distribution of the sudden oak death epidemic. The dispersal pressure incorporated in the statistical model estimates the force of invasion at all susceptible locations, allowing us to quantify the relative likelihood of current disease incidence rather than its potential distribution. Our predictions show that 65 km^2 of forested land was invaded by 2009, but further disease spread threatens more than 2100 km^2 of forests across the western region of Oregon (very high and high risk). Areas at greatest risk of disease spread are concentrated in the southwest region of Oregon where the highest densities of susceptible host species exist. This research identifies high priority locations for early detection and invasion control and illustrates how iSDMs can be used to analyze the actual versus potential distribution of emerging infectious disease in a complex, heterogeneous ecosystem.

FUNDING

The National Ornamentals Research Site at Dominican University of California (NORS-DUC) has issued their Request for Proposals (RFP) for fiscal year 2011-2012. Proposals reflecting short-term applied research are requested for development or validation of Best Management Practices (BMP) and research that leads to science-based mitigations to manage *P. ramorum*. Research priorities include, but are not limited to, methods development to inhibit *P. ramorum* spread and epidemiological studies on inoculum sources, pathways, soil sampling focal points, and disease distribution in nurseries. Proposals are due by Friday, 10/29/10. Approximately $200,000 is available to fund projects ranging from $15,000 to $50,000. For additional information, contact Sibdas Ghosh at sibdas.ghosh@dominican.edu or (415) 482-3583.

The CFIA has extended the application deadline for *P. ramorum*-related compensation to December 31, 2012. Reimbursements are intended to cover compliance costs associated with regulatory controls ordered by the CFIA. This includes disposal of infested plant material and soil, and loss of intended use for the plant material. For more information, contact John McDonald at (613) 773-7178 or John.G.McDonald@inspection.gc.ca.

RELATED RESEARCH

DiLeo, M.V.; Pye, M.F.; Roubtsova, T.V.; Duniway, J.M.; MacDonald, J.D.; Rizzo, D.M.; and Bostock, R.M. 2010. Plant Stress and Abiotic Disorders: Abscisic Acid in Salt Stress Predisposition to *Phytophthora* Root and Crown Rot in Tomato and

Chrysanthemum. Phytopathology, Volume 100, Number 9, 871-879. DOI: 10.1094/PHYTO-100-9-0871.

Hulvey, J.; Gobena, D.; Finley, L.; and Lamour, K. 2010. Co-occurrence and genotypic distribution of *Phytophthora* species recovered from watersheds and plant nurseries of eastern Tennessee. Mycologia, 102(5), pp. 1127–1133. DOI: 10.3852/09-221.

Vanwalleghem, T. and Meentemeyer, R.K. 2009. Predicting forest microclimate in heterogeneous landscapes. Ecosystems 12(7): 1158-1172. DOI: 10.1007/s10021-009-9281-1.

EDUCATION AND OUTREACH

A "Pest Fest Costume Contest" is being held at the 6th Annual Meeting of the Continental Dialogue, October 5 – 6, 2010 in Waltham, Massachusetts. The contest is intended to be a fun and social evening event, highlighting the importance of outreach and education about the growing threat to North American forests from non-native insects and diseases. Attendance at the meeting is not required to enter your pest costume. Due by September 30, 2010, all costumes must be of an invasive insect or disease (such as *P. ramorum*) that kills trees. For additional information on costume eligibility requirements and how to enter the contest, go to http://www.continentalforestdialogue.org/events/dialogue/2010-10-05/index.html.

Free *P. ramorum* Prevention Workshops for Grower Nurseries – In response to increasing international interest in "clean stock" nursery programs, the California Department of Food and Agriculture (CDFA), in cooperation with the California Association of Nurseries and Garden Centers (CANGC), is offering workshops this fall that focus on best management practices (BMP) aimed at minimizing the risk of *P. ramorum* introduction into nurseries, the spread of disease within nurseries, and pathogen spread through the sale of plant material. At the workshops, nursery owners and staff will work with CDFA's Primary Plant Pathologist as well as Nursery Program Specialists to develop individually tailored BMP programs for each nursery. Funding for the workshops is made possible through a USDA/Foreign Agricultural Service Technical Assistance for Specialty Crops grant that was awarded to CANGC. For more information, see the "Calendar of Events" below. Additional information will be forthcoming about other workshop locations.

Four *P. ramorum* Preventative Treatment Training sessions are being offered this fall on the UC Berkeley campus. Each two-hour outdoor session will cover basic Sudden Oak Death information, integrated pest management approaches, how to select candidate trees for treatment, and proper preventative treatment application. CEU credits are being applied for with DPR, ISA, SAF, and California Urban Forestry Council. For more information, see the "Calendar of Events" below.

CALENDAR OF EVENTS

9/9 – *P. ramorum* Prevention Workshop for Grower Nurseries: Developing a Best Management Practices Program for your Nursery; 9:30 a.m. – 12:00 p.m.; Tulare County Agricultural Center, 4437 S. Laspina Street, Tulare, CA 93274; To register, or for more information, contact Kathy Kosta, Primary State Plant Pathologist, California Department of Food and Agriculture at (916) 651-2846 or kkosta@cdfa.ca.gov.

9/15 – SOD Treatment Workshop; Meet at oak outside of Tolman Hall, UC Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. This class is free and will be held rain or shine. To register, email kpalmieri@berkeley.edu, and provide your name, phone number, affiliation (if applicable), and the date for which you are registering. For more information, go to http://nature.berkeley.edu/garbelotto/english/sodtreatmenttraining.php or contact Katie Palmieri at (510) 847-5482 or kpalmieri@berkeley.edu.

9/28 – *P. ramorum* Prevention Workshop for Grower Nurseries: **Developing a Best** Management Practices Program for your Nursery; 9:30 a.m. – 12:00 p.m.; UC Cooperative Extension, 5630 South Broadway Street, Eureka, CA 95503-6905; For more information, see the 9/9 listing above.

10/5 – 10/6 – Continental Dialogue on Non-Native Forest Insects and Diseases Sixth Dialogue Meeting; Brandeis University; 415 South Street, Waltham, Massachusetts; To register, go to http://www.continentalforestdialogue.org/.

10/6 - SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. For more information, see the 9/15 listing above.

10/20 - SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. For more information, see the 9/15 listing above.

11/3 – SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. For more information, see the 9/15 listing above.

11/16 – 17 – 59th Annual Meeting of the California Forest Pest Council; Wildland Fire Training and Conference Center; 3237 Peacekeeper Way; McClellan; Agenda and registration information will be posted to http://caforestpestcouncil.org/2010/08/2010-california-forest-pest-council-59th-annual-meeting/ in the near future. For more information contact Kim Camilli at (805) 550-8583 or kim.camilli@fire.ca.gov.