# CALIFORNIA OAK MORTALITY TASK FORCE REPORT
# APRIL 2010

## RESEARCH FOCUS

**The 2009 UK sites where Japanese larch (*Larix kaempferi*) were found with** *Phytophthora ramorum* foliar and stem infections, yet not in close proximity to *Rhododendron ponticum*, have more recently been found to have a range of other woodland and commercial plantation species affected by the pathogen (primarily bole canker infections). Tests conducted by UK Forest Research have shown that the Japanese larch foliage strongly supports *P. ramorum* sporulation, possibly even to the extent seen on California bay laurel (*Umbellularia californica*). Foliar infections on larch appear to be able to generate hundreds and even thousands of sporangia on a single infected needle. This inoculum load high in the crowns of affected Japanese larch has likely lead to widespread local infection on the foliage and boles of nearby susceptible tree and understory species, as well as caused bole infections on the larch.

Affected species of the larch understory include beech (*Fagus sylvatica*), sweet chestnut (*Castanea sativa*), and oak species (*Quercus* spp), all of which are known to suffer from bole cankers, as well as birch (*Betula pendula*), which has not previously been found as a bole host. Over the past 6 months a number of conifer species have also emerged as bole hosts, including western hemlock (*Tsuga heterophylla*), Port Orford cedar (*Chamaecyparis lawsoniana*), and Douglas-fir (*Pseudotsuga menziesii*); however, only one or two individuals of these conifer hosts have so far been confirmed *P. ramorum* positive. Western hemlock has also been confirmed as a foliar host of the pathogen.

This upsurge in *P. ramorum* and the many new hosts that are emerging is strongly correlated with proximity to larch exhibiting crown dieback. The number of sites where this is known to be occurring is limited. Control measures are now underway, which includes felling the larch to prevent further sporulation following budburst in the spring. For more information and details of symptoms, go to http://www.forestry.gov.uk/forestry/INFD-7XVEWH and http://www.forestry.gov.uk/website/forestry.nsf/byunique/infd-5vfmzu or contact Joan Webber at joan.webber@forestry.gsi.gov.uk.

## REGULATIONS

**A lawsuit was filed on 3/8/10 in Columbia, South Carolina by the California** Association of Nurseries and Garden Centers (CANGC) and the Oregon Association of Nurseries (OAN), seeking to overturn a new South Carolina regulation that requires California and Oregon growers shipping plants to SC to comply with additional inspection, documentation and advance notice requirements which are more restrictive than the federal *P. ramorum* rules. The suit, which names the State of South Carolina and the South Carolina Department of Agriculture, challenges the new regulation as both unconstitutional and prohibited by the Plant Protection Act.

California and Oregon are leading states for production of nursery products, shipping ornamental plants, trees, shrubs, bulbs, and other horticultural products across the nation and internationally. Nurseries in Oregon and California are fully complying with the *P. ramorum* federal order; however, they have had their shipments blocked and plants destroyed as a result of the SC regulation, and have lost orders and marketing relationships.

**The USDA APHIS Plant Protection and Quarantine (PPQ) program conducted a** National Review of the *P. ramorum* regulatory program December 15 - 16, 2009. The meeting was attended by approximately 50 invited representatives. The primary goal of the meeting was to develop a clear program vision, goals, and action plans as well as to gather feedback on program successes and those areas that need improvement. To access the summary report of the program review outcomes, including the vision statement, short and long-term goals, and action items, go to the APHIS website at http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/downloads/review_2009/NationalReviewReport.pdf.

## NURSERIES

**A Lancaster County, Pennsylvania production nursery was found to have *P. ramorum*-positive *Laurus nobilis*** on 3/15/10. Trace-forward investigations found that five western and 21 eastern states received *Laurus nobilis* (bay laurel) plants from the nursery. This nursery has never previously been positive for the pathogen. To date, samples taken from trace-forward nurseries have all been negative for *P. ramorum*.

**A retail nursery in Mecklenburg County, NC was found to have *P. ramorum*-** positive soil on 3/26/10. A follow-up nursery survey is being conducted. This nursery was previously positive for *P. ramorum* in 2008 and 2009. The nursery does not ship interstate.

**A Greenville County, South Carolina retail nursery was confirmed *P. ramorum*** positive on April 2, 2010, with infected *Kalmia latifolia*. This nursery was also positive in 2008. The detection was the result of an unrelated incoming nursery shipment inspection. The nursery does not ship interstate.

**A Clackamas County, OR wholesale nursery that occasionally ships interstate was** found to have a *P. ramorum*-positive *Camellia* 'Colonel Frey' plant on 3/26/10 during a regulatory compliance survey. The find was part of the Oregon Department of Agriculture's (ODA) 2010 Federal Order Survey. Delimitation surveys, trace-forward, and trace-back investigations are underway because *P. ramorum* was isolated from the plant. This is the first time this nursery has been found positive for the pathogen.

The USDA Confirmed Nursery Protocol (CNP) carried over into 2010 for two Oregon nurseries in which *P. ramorum* was detected last year. One of the nurseries has since completed CNP requirements and has been released. The other location, a recurrent nursery that was positive four years in a row, remains under an Oregon Administrator's

Directive that requires the nursery to take extra precautions to prevent the introduction and potential spread of *P. ramorum.* This includes a prohibition against moving any *Rhododendron, Camellia, Pieris, Kalmia,* and *Viburnum* off site.

**A Clark County, WA production nursery was found to have *P. ramorum* infested** soil on 3/10/10. A delimiting survey was conducted. This nursery was also found *P. ramorum* positive in 2008 and 2009.

## RESEARCH

**2010 Research Needs Assessment (RNA) for *P. ramorum* in Nursery and Forest** Environments - The California Oak Mortality Task Force is partnering with the USDA Forest Service Pacific Southwest Research Station to solicit research needs for *P. ramorum*. The RNA is a two-phase process being conducted through online surveys. Round 1 (now closed for response analysis) asked participants to provide feedback on the three most important research needs for either forests and wildlands or nursery environments. Round 2 will ask participants to prioritize compiled research needs submitted during Round 1. It is anticipated that Round 2 surveys will be advertised and distributed in mid-April. Participation in the Round 2 survey is not contingent upon prior participation. All interested parties are encouraged to submit feedback. Presentation of the findings and solicitation of feedback will occur at the June 2010 COMTF meeting. For more information, contact Janice Alexander at jalexander@ucdavis.edu or (415) 499-3041.

**Norway has developed a *P. ramorum* Pest Risk Assessment. Findings of the** assessment were adopted on 6/24/09. While it is believed that the pathogen is not widely distributed, a thorough survey of the country has not been completed, so current distribution is not totally known. The assessment did determine that the overall probability of *P. ramorum* entry into Norway and the probability of its becoming established are high. Areas considered to be at greatest risk are gardens and parks with *Rhododendron* spp., *Viburnum* spp, and *Fagus sylvatica* as well as areas in the wild into which *Rhododendron* spp. has spread and woods with *F. sylvatica*.

**Cobb, R.C.; Meentemeyer, R.K.; and Rizzo, D.M. 2010. Apparent competition in** canopy trees determined by pathogen transmission rather than susceptibility. Ecology 91(2):327–333.

Abstract: Epidemiological theory predicts that asymmetric transmission, susceptibility, and mortality within a community will drive pathogen and disease dynamics. These epidemiological asymmetries can result in apparent competition, where a highly infectious host reduces the abundance of less infectious or more susceptible members in a community via a shared pathogen. We show that the exotic pathogen *Phytophthora ramorum* and resulting disease, sudden oak death, cause apparent competition among canopy trees and that transmission differences among canopy trees drives patterns of disease severity in California coast redwood forests. *P. ramorum* ranges in its ability to infect, sporulate on, and cause mortality of infected hosts. A path analysis showed that

the most prolific inoculum producer, California bay laurel (*Umbellularia californica*), had a greater impact on the mortality rate of tanoak (*Lithocarpus densiflorus*) than did other inoculum-supporting species. In stands experiencing high tanoak mortality, lack of negative impacts by *P. ramorum* on bay laurel may increase bay laurel density and subsequently result in positive feedback on pathogen populations. This study demonstrates the degree to which invasive, generalist pathogens can cause rapid changes in forest canopy composition and that differences in transmission can be more important than susceptibility in driving patterns of apparent competition.

**De Dobbelaere, I.; Vercauteren, A.; Speybroeck, N.; Berkvens, D.; Van Bockstaele,** E.; Maes, M.; and Heungens, K. 2010. Effect of host factors on the susceptibility of *Rhododendron* to *Phytophthora ramorum*. Plant Pathology Volume 59, Issue 2:301–312. DOI: 10.1111/j.1365-3059.2009.02212.x.

Abstract: *Phytophthora ramorum* causes sudden oak death (SOD) in western coastal forests of the USA. In Europe, the pathogen is mainly present in the nursery industry, particularly on *Rhododendron*. Because of the primary role of *Rhododendron* as a host and potentially as a vector, the effect of *Rhododendron* host factors on *P. ramorum* susceptibility and sporulation was investigated. Inoculation methods using either wounded or non-wounded detached leaves were applied to 59 *Rhododendron* cultivars and 22 botanical species, replicated in three separate years. All *Rhododendron* species and cultivars were susceptible when using wounded leaves, but not when using non-wounded leaves, suggesting a resistance mechanism operating at the level of leaf penetration. Using a regression tree analysis, the cultivars and species were split into four susceptibility classes. Young leaves were more susceptible than mature leaves when wounded, but less susceptible when non-wounded. This effect was not correlated with leaf hydrophobicity or the number of leaf hairs. The presence or the type of rootstock did not affect the cultivar susceptibility level. Sporangia and chlamydospore production in the leaf lesions varied widely among *Rhododendron* cultivars and was not correlated with the susceptibility level. The susceptibility to *P. ramorum* correlated well with the susceptibility to *P. citricola* and *P. hedraiandra* x *cactorum*, suggesting that the resistance mechanisms against these species are non-specific. Susceptibility to *P. kernoviae* was low for most cultivars. These findings have implications for detection, spread and disease control, and are therefore important in pest risk assessment.

**McPherson, B.A.; Mori, S.R.; Wood, D.L.; Kelly, M.; Storer, A.J.; Svihra, P.; and** Standiford, R.B. 2010. Responses of oaks and tanoaks to the sudden oak death pathogen after 8 years of monitoring in two coastal California forests. Forest Ecology and Management. In press. DOI: 10.1016/j.foreco.2010.02.020.

Abstract: Sudden oak death, caused by *Phytophthora ramorum*, is widely established in mesic forests of coastal central and northern California. In 2000, we placed 18 plots in two Marin County sites to monitor disease progression in coast live oaks (*Quercus agrifolia*), California black oaks (*Q. kelloggii*), and tanoaks (*Lithocarpus densiflorus*), the species that are most consistently killed by the pathogen in these areas. Through early

2008, the numbers of newly infected trees increased for all species. The infection rate for trees that were asymptomatic in 2000 was 5.0% $y^{-1}$ for coast live oaks, 4.1% $y^{-1}$ for black oaks and 10.0% $y^{-1}$ for tanoaks. Mortality rates were 3.1% $y^{-1}$ for coast live oaks, 2.4% $y^{-1}$ for black oaks, and 5.4% $y^{-1}$for tanoaks. Mortality not attributed to *P. ramorum* was 0.54% $y^{-1}$ for coast live oaks, and 0.75% $y^{-1}$ for tanoaks. Weibull survival models of trees that were asymptomatic in 2000 provided overall median survival times of 13.7 y for coast live oaks, 13.8 y for black oaks, and 8.8 y for tanoaks. Survival of infected (bleeding) trees declined to 9.7 y for coast live oaks, 6.2 y for black oaks, and 5.8 y for tanoaks. Ambrosia beetle attacks on bleeding trees further reduced modeled survival times by 65–80%, reaffirming the earlier finding that beetle attacks on bleeding cankers considerably reduce survival. Across all plots, the modeled time for 90% of trees that were asymptomatic in 2000 to become infected is 36.5 y for coast live oaks and 15.4 y for tanoaks. There was a trend toward higher infection rates as tree diameter increased. Greater than 90% of living coast live oaks that failed during the study had extensive beetle tunneling at the site of the break. Disease intensity in coast live oaks at the plot level was positively associated with bay laurel (*Umbellularia californica*) basal area and negatively associated with Pacific madrone (*Arbutus menziesii*) basal area. This study demonstrates the use of survival modeling to characterize the effects of epidemic disease on different species and to project the future of forests infected with tree pathogens.

**Vettraino, A.M.; Sukno, S.; Vannini, A.; and Garbelotto, M. 2010. Diagnostic** sensitivity and specificity of different methods used by two laboratories for the detection of *Phytophthora ramorum* on multiple natural hosts. Plant Pathology 59:289–300. DOI: 10.1111/j.1365-3059.2009.02209.x.

Five detection methods were comparatively tested on putative *Phytophthora ramorum* field samples from 41 wild plant species. The tested methods included two culture-based assays, a DAS-ELISA-based polyclonal assay, a nested PCR-based assay, and a TaqMan real-time PCR assay. Diagnostic values including sensitivity, specificity, positive predictive value and negative predictive value were calculated for each method. The effects of host species, seasonality and host location were analyzed and compared between two laboratories. Significant effects of season, host species and laboratory were detected. It is concluded that a combination of either culturing and molecular diagnosis or of two molecular assays is the most promising approach to diagnose this pathogen. Based on the results of this and other studies, diagnosis should occur as much as possible during wet and warm periods favourable to the pathogen, and proficiency tests should be performed to compare results obtained with molecular approaches in different laboratories. Furthermore, length of time lapsed between sample collection and processing strongly affected the diagnostic sensitivity of culture-based methods, and therefore needs to be taken into account when comparing results from different laboratories.

**Widmer, T.L. 2010. Differentiating *Phytophthora ramorum* and *P. kernoviae* from** other species isolated from foliage of rhododendrons. Online. Plant Health Progress. DOI: 10.1094/PHP-2010-0317-01-RS.

Abstract: *Phytophthora* species are among plant pathogens that are the most threatening to agriculture. After the discovery of *P. ramorum*, surveys have identified new species and new reports on rhododendrons. Based upon propagule production, morphology, and colony growth, a dichotomous key was produced that can differentiate *P. ramorum* and *P. kernoviae* from other species known to be pathogenic to aerial plant parts of rhododendrons. These distinctions were made without molecular tools and wide-ranging variables such as propagule sizes and can be made without the need for a large culture collection.

## RELATED RESEARCH

**Amoroso, M.M. and Larson, B.C.2010. Stand development patterns as a** consequence of the mortality in *Austrocedrus chilensis* forests. Forest Ecology and Management. In press. DOI: 10.1016/j.foreco.2010.02.009.

**Brasier, C.M.; Vettraino, A.M.; Chang, T.T.; and Vannini, A. 2010. *Phytophthora lateralis*** discovered in an old growth *Chamaecyparis* forest in Taiwan. Plant Pathology. DOI: 10.1111/j.1365-3059.2010.02278.x.

**Durán, A.; Slippers, B.; Gryzenhout, M.; Ahumada, R.; Drenth, A.; Wingfield,** B.D.; and Wingfield, M.J. 2009. DNA-based method for rapid identification of the pine pathogen, *Phytophthora pinifolia*, FEMS *Microbiology Letters*, Vol. 298(1):99-104.

## EDUCATION AND OUTREACH

**Two free May workshops, "Sudden Oak Death Updates for Foresters and** Landowners" will be offered by the California Oak Mortality Task Force in Ukiah and Eureka. The workshops will cover the latest *P. ramorum* regulatory requirements as well as up-to-date pathogen information that land managers need to know to limit disease impacts. The status of California's wildlands affected by Sudden Oak Death will also be discussed, including new infested areas, predicted spread, wildfire risks, and continued SOD impacts on affected forest-product industries. Although these free workshops are primarily intended for people working in the woods, anyone interested is invited to attend. For more information, see the Calendar of Events below.

**Sudden Oak Death (SOD) Blitzes will be held in several locations this spring**. **Blitzes** are intended to engage people in SOD issues as they relate to their local areas, and to assist communities in identifying locations where the pathogen is present. Participants will be given a two-hour training on identifying symptoms, correctly sampling symptomatic plants, and documenting sample locations. For Blitz dates and locations, see the "Calendar of Events" below. For more information on the Blitzes, go to http://nature.berkeley.edu/garbelotto/english/sodblitz.php.

**The California Oak Mortality Task Force will be holding their annual meeting 6/8** – 6/11 at Embassy Suites and Dominican University in San Rafael. On 6/8 there will be a welcome reception at the Embassy Suites. The meeting will be kicked off June 9 at Dominican University in the morning, with a National Ornamental Research Site (NORS-

DUC) field trip and indoor nursery session in the morning, and will transition to a wildland Sudden Oak Death field trip in the afternoon. The evening of June 9 there will be a Nursery Committee meeting at the Embassy Suites. June 10 will be at Dominican University for the day, and will include policy and research updates, a panel discussion on impacts and management of Sudden Oak Death, and a Research Needs Assessment for Forestry and Nursery issues. June 11 there will also be the first meeting of the Continental Dialogue's *Phytophthora ramorum* Initiative working group. Registration for the meeting is now available online at http://www.suddenoakdeath.org/html/comtf_annual_meeting_2010.html. Information regarding how to reserve a room at the Embassy Suites using the meeting discounted rate will be posted to the website by 4/9. For more information, contact Katie Palmieri at (510) 847-5482 or kpalmieri@berkeley.edu.

## COMTF ACCOMPLISHMENT REPORTING

**The 2009 Summary for Education and Outreach Activities of the COMTF is now** available online. Reaching an estimated 100,000 people last year, activities were focused on reducing human-caused spread of *P. ramorum* to uninfested areas, and minimizing the spread and impacts of Sudden Oak Death where tree mortality has already occurred. To access the summary, go to http://nature.berkeley.edu/comtf/pdf/COMTF_2009_Outreach_Report.pdf.

## CALENDAR OF EVENTS

**4/17 - Sonoma Area SOD Blitz Initial Meeting and Training; Two meeting** opportunities: 9:00 a.m. Environmental Discovery Center, Spring Lake Park, Santa Rosa and 10 a.m. Healdsburg Branch, Sonoma County Library, Sonoma; For more information, contact Lisa Bell at lkbell@ucdavis.edu.

**4/21 - 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.

**4/24 East Bay Region SOD Blitz Initial Meeting and Training; 114 Morgan Hall,** UC Berkeley Campus, Berkeley; 10:30 a.m.; For more information, contact Lydia Smith at smilydia@gmail.com.

**5/1 Marin County SOD Blitz Initial Meeting and Training; Creekside Room,** Dominican University; 10 a.m; For more information, contact Sarah Gardner at sarah.gardner@dominican.edu.

**5/8 Atherton Area SOD Blitz Initial Meeting and Training; The Carriage House,** Holbrook-Palmer Park; 150 Watkins Ave., Atherton; 10:00 a.m.; For more information, contact Susan Finocchio at susanfin@earthlink.net.

**5/12 - 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 4/21 listing above.

**5/12** **Free "Sudden Oak Death Update for Foresters and Landowners;"** UCCE/County Agriculture Department; 890 N. Bush Street, Ukiah; 1-5 pm; For more information, or to register, contact Chris Lee at (707) 445-7351.

**5/13** **Free "Sudden Oak Death Update for Foresters and Landowners;" Humboldt** County Agriculture Center; 5630 S. Broadway, Eureka; 8:30 am - 12:30 pm; For more information, or to register, contact Chris Lee at (707) 445-7351.

**5/15** **Los Altos Area SOD Blitz Initial Meeting and Training; Town Hall; 26379** Fremont Road, Los Altos; 10:30 a.m.; For more information, contact Sue Welch at sodblitz09@earthlink.net.

**5/22** **Woodside Area SOD Blitz Initial Meeting and Training; For more** information, contact Debbie Mendelson at naturemend@sbcglobal.net.

**6/8 – 6/11 – COMTF-wide meeting; Dominican University; 50 Acacia Avenue;** San Rafael, CA 94901-2298; Additional information will be forthcoming. For questions, contact Katie Palmieri at (510) 847-5482 or kpalmieri@berkeley.edu.