



CALIFORNIA OAK MORTALITY TASK FORCE REPORT OCTOBER 2006

MANAGEMENT

A North Coast Sudden Oak Death Advisory Group convened its fourth annual meeting in Eureka on 9/14 to discuss *Phytophthora ramorum* management strategies and impacts. The group, comprised of local public and private landowners and land managers, as well as regulatory officials and state and federal legislative staff, worked on coordinating a strategic 2006/07 *P. ramorum* program for the area. Support to continue slow the spread efforts was great, as it was recognized that the recent spread in Humboldt County is still relatively small and isolated compared to the size of the county, and current infestations could serve as inoculum sources which could ultimately impact thousands of uninfested acres. Topics addressed at the meeting included 1) responding to *P. ramorum* outbreaks, 2) improving public understanding of Sudden Oak Death and Humboldt County treatment efforts, 3) expanding cooperator and financial support, and 4) refining educational messages targeted at Mendocino, Humboldt, and Del Norte Counties.

At the meeting, the group viewed the current status of the disease and the experimental control efforts implemented over the last 8 months, on over 120 acres. These experimental silvicultural treatments are located at the known edges of Humboldt County's *P. ramorum*-infested area. They were carried out by UCCE Humboldt-Del Norte, with the California Department of Forestry and Fire Protection, California State Parks, Southern Humboldt Fire Safe Council, CalTrans, and private landowners and contractors. The treatments were conducted on four parcels involving a replicated study of bay laurel and tanoak removal in combination with pile and broadcast burning. The controlled burns are planned for this fall. With these targeted tree removal efforts, researchers hope to reduce pathogen sporulation and change the conditions of the stands to discourage pathogen persistence. On each of the properties, additional treatments, designed as case study experiments, were also included.

These treatments will be used to help develop a better understanding of how individual landowners can manage stands of trees that have been invaded by *P. ramorum*. The treatments are also intended to be complementary to the landowner's long-term goals for their forested properties, such as resilience to fire, returning conifers to dominance in stands where they were removed, and protecting adjacent uninfected hardwood stands. Along with similar treatments being planned by the UC Davis, UC Berkeley, and Phytosphere Research in Big Sur and Sonoma County, these stand manipulations should provide data to enhance our understanding of the effects of various kinds of management on *P. ramorum* survival and impact.

The Mid-Peninsula Regional Open Space District hosted the first COMTF Conservation Committee meeting for land managers on 9/7/06 in Los Altos, CA. More than 30 representatives from a variety of agencies attended, including the Bureau of Land Management, CA Dept. of Fish and Game, CA State Parks, East Bay Regional Park



District, East Bay Municipal Utility District, Elkhorn Slough National Estuarine Research Reserve, Marin Municipal Water District, San Mateo County Parks, Sonoma County Open Space, and the U.S. Fish and Wildlife Service. The day-long meeting provided a forum for information sharing and needs gathering, and resulted in a prioritized list of needs for land managers dealing with *P. ramorum* issues in both park and wildland settings. The top five research priorities identified were: pathogen spread; fire risk and use of fire for disease prevention and treatment; resistant stock development; and the need for additional treatment options. Training and assistance with ecological issues was also identified as a priority. This list will be used to help prioritize future research needs as well as identify educational outreach opportunities.

REGULATIONS

Koch's postulates have been completed for: *Acer pseudoplatanus*, *Aesculus hippocastanum*, *Laurus nobilis*, and *Michelia doltsopa*. Consequently, these hosts will be reclassified from the *P. ramorum* associated host list to the list of "Proven Hosts Regulated for *Phytophthora ramorum*."

RESEARCH

The abstract submission process for the Sudden Oak Death Science Symposium III has been updated to a web-based submission system. Please use the following link when submitting your paper: <http://www.x-cd.com/sodssymposium/abstract.cfm>. We will also be using a similar system for the peer review process when papers are submitted this spring.

Manter, D.K., Karchesy, J.J., Kelsey, R.G. 2006. The sporicidal activity of yellow-cedar heartwood, essential oil and wood constituents towards *Phytophthora ramorum* in culture. For. Path 36:297–308.

Summary: In this paper, we demonstrate that 140 mg/kg of essential oil from the wood of yellow-cedar, incense cedar, Port-Orford-cedar or western juniper strongly inhibits zoospore germination and hyphal growth of *Phytophthora ramorum* in culture. Four individual compounds in yellow-cedar heartwood were also tested. Zoospore germination was reduced to 0% with 10, 100 and 1000 mg/kg of nootkatin, carvacrol and valencene, respectively. Nootkatone was the least active compound, with 3.5% zoospore germination at 1000 mg/kg. Sporangia germination was 0% with 500 mg/kg of nootkatin or carvacrol. The disruption of the zoospore outer membrane and the loss of sporangial contents were often observed and indicative of sporicidal activity. Hyphal growth was inhibited by 99.9% with 50 mg/kg of nootkatin or 500 mg/kg of carvacrol, but growth resumed upon removing the inhibitors. The zoosporicidal activity of yellow-cedar heartwood shavings stored dry for approximately 10 years was consistent with the quantity of extractable compounds they contained. Thus, spreading fresh shavings or chips of yellow-cedar heartwood with appreciable higher concentrations of the active compounds, over areas in infection zones where spores might be difficult to control such as trails and parking lots used by hikers and bicyclists, might be useful as part of an integrated program to minimize *P. ramorum* spore distribution.



Schena, Leonardo, Hughes, Kelvin J.D., and Cooke, David E.L. 2006. Detection and quantification of *Phytophthora ramorum*, *P. kernoviae*, *P. citricola*, and *P. quercina* in symptomatic leaves by multiplex real-time PCR. *Molecular Plant Pathology* 7(5), 365–379. DOI: 10.1111/J.1364-3703.2006.00345.

Summary: New species of *Phytophthora* such as *Phytophthora ramorum*, *P. kernoviae*, and *P. quercina* together with *P. citricola* are plant pathogens which impact on forest health, natural ecosystem stability and international trade. A real-time multiplex PCR approach based on TaqMan PCR was developed to simultaneously identify and detect these four *Phytophthora* species. Specific primers and probes labeled with FAM (*P. ramorum*), Yakima Yellow (*P. kernoviae*), Rox (*P. citricola*) and Cy5 (*P. quercina*) were designed in different regions of the ras-related protein (Ypt1) gene. A new set of Black Hole Quenchers (BHQ), which dissipate energy as heat rather than fluorescence, were utilized. The method proved to be highly specific in tests with target DNA from 72 *Phytophthora* isolates (35 species). For all pathogens, the detection limit was 100 fg of target DNA and was not improved utilizing a nested approach to provide a first round of amplification with *Phytophthora* spp.-specific primers. Cycle threshold (Ct) values were linearly correlated with the concentration of the target DNA (correlation coefficients ranged from 0.947 to 0.996) and were not affected by the presence of plant extracts, indicating the appropriateness of the method for qualitative and quantitative analyses. Two universal primers and a TaqMan probe were also developed to evaluate the quality and quantity of extracted DNA and to avoid false negatives. The reliability of the entire procedure was assessed using both artificially and naturally infected leaves of a range of plant species. The method, combined with a rapid procedure for DNA extraction, proved to be rapid, reliable, sensitive and cost effective as multiple pathogens were detected within the same plant extract by using different primer/probe combinations.

The following abstracts are from papers to be presented at the 6th California Oak Symposium. Additional Symposium information can be found on the website at: http://danr.ucop.edu/ihrmp/symposium_abstracts.html.

Abstract 4: Contemporary California Indians, Oaks, and *Phytophthora ramorum* (Sudden Oak Death). *Beverly Ortiz, CSUEB/Self/EBRPD*

Abstract 16: Woodland Structure Affects Intensity of Infection by an Exotic Forest Pathogen. *Nathan Rank, Sonoma State University; Hall Cushman, Sonoma State University; and Ross Meentemeyer, University of North Carolina at Charlotte*

Abstract 18: Consequences of *Phytophthora ramorum* Infection in Oaks and Tanoaks. *Brice McPherson, University of California; David Wood, University of California; Sylvia Mori, United States Forest Service; Richard Standiford, University of California; and Maggi Kelly, University of California*



Abstract 20: Impacts of *Phytophthora ramorum* Canker and Other Agents in Sonoma County. *Tedmund Swiecki, Phytosphere Research and Elizabeth Bernhardt, Phytosphere Research*

Abstract 22: Susceptibility to Sudden Oak Death in California Bay Laurel. *Brian Anacker, Sonoma State University; Nathan Rank, Sonoma State University; Daniel Huberli, UC Berkeley; Matteo Garbelotto, UC Berkeley; Sarah Gordon, Sonoma State University; Rich Whitkus, Sonoma State University; and Ross Meentemeyer, University of North Carolina at Charlotte*

Abstract 23: Forest Response to an Emerging Disease: Sudden Oak Death in Coastal California. *Letty Brown, University of California, Berkeley and Barbara Allen-Diaz, University of California, Berkeley*

Abstract 25: Effects of Recreation on the Dispersal of Exotic Forest Pathogen, *Phytophthora ramorum*. *Michelle Cooper, Sonoma State University, Department of Biology and Hall Cushman, Sonoma State University, Department of Biology*

Abstract 27: Human Activity and Spread of the Pathogen That Causes Sudden Oak Death. *Hall Cushman, Sonoma State University and Ross Meentemeyer, University of North Carolina at Charlotte*

Abstract 29: GIS-Based Epidemiological Modeling of an Emerging Forest Disease: Spread of Sudden Oak Death Across California Landscapes. *Rich Hunter, Sonoma State University and Ross Meentemeyer, University of North Carolina at Charlotte*

Abstract 31: Long-Term Change in Oak Woodlands and Its Influence on a Forest Disease. *Ross Meentemeyer, University of North Carolina at Charlotte and Hall Cushman, Sonoma State University*

Abstract 33: Gap Dynamics in Oak Woodlands Across a Gradient of Disturbance *Tim De Chant, University of California, Berkeley, Dept. of Environmental Science, Policy and Management and Maggi Kelly, University of California, Berkeley, Dept. of Environmental Science, Policy and Management*

Abstract 41: Regeneration of Oaks and Tanoak in *Phytophthora ramorum*-Affected Forests. *Tedmund Swiecki, Phytosphere Research and Elizabeth Bernhardt, Phytosphere Research*

Abstract 49: Molecular Markers Show How Pollen and Seed Dispersal Affect Population Genetic Structure in Coast Live Oak (*Quercus agrifolia* née). *Richard Dodd, University of California; Zara Afzal-Rafii, Universite d'Aix-Marseille III; and Wasima Mayer, University of California*

Abstract 59: Determining the Role of Plant Community and Landscape Change in the Sudden Oak Death Disease Complex. *Timothy Doherty, University of Berkeley,*



ESPM; Barbara Allen-Diaz, University of Berkeley, ESPM; and Maggi Kelly, University of Berkeley, ESPM

NURSERIES

To date, 56 nurseries have been positive for *P. ramorum* in 2006. The breakdown by state is: CA (26), OR (13), WA (8), AL (1), CT (1), FL (2), GA (1), IN (1), ME (1), MS (1), and PA (1).

Forty-six states have reported *P. ramorum* National Nursery Survey results (Alaska, Iowa, Missouri, and Puerto Rico are not participating.), and Wisconsin is looking for *P. ramorum* as part of their regular nursery inspection. To date, 3,513 nurseries have been visited and 95,295 samples collected. Out of the samples collected, 352 have been confirmed *P. ramorum*-positive.

MONITORING

The USDA Forest Service (FS) and states are conducting nursery perimeter and general forest detection surveys. To date, 567 nursery perimeter surveys have been conducted in 29 states, with 1,498 samples collected. Additionally, 320 general forest surveys have been conducted in 29 states, with 765 samples collected. To date, all samples tested have been found negative for the pathogen.

EDUCATION

Please note that an upcoming Christmas tree research field tour, as well as Southern California nursery training sessions and key symposia, are listed under the Calendar of Events.

OAKMAPPER: FEATURED RESOURCE

Access to timely and accurate information is critical for Sudden Oak Death (SOD) monitoring, management, and research. Researchers in the Kelly Lab at UC Berkeley maintain several websites associated with SOD monitoring efforts. These websites display the most current maps on *P. ramorum* distribution in California, and provide a suite of derived data products to interested parties and the general public.

The websites make up OakMapper, the online hub for up-to-date SOD distribution in California, which provides information to the public, and maintains and displays the most current spatial and attribute data available on *P. ramorum*. The OakMapper is a valuable tool accessed by many for resource management; disease monitoring and modeling; and education and outreach. OakMapper users include Task Force members, SOD researchers, arborists, forestry personnel, nursery personnel, regulators, Legislators, and community members.

OakMapper site (<http://www.oakmapper.org/>) components include:

- downloadable state, county, and local maps, as well as custom maps of local areas of interest, available upon request by emailing: OakMapper@nature.berkeley.edu.



- an OakMapper webGIS application, which offers a number of functions, including data visualization. This program allows the viewer to see all OakMapper data, including: confirmed *P. ramorum* trees; symptomatic SOD trees submitted via an online form (“SOD sightings”); host species coverage areas; federal, state, and regional parks; highways, interstates, and local roads; SOD photo locations; a statewide SOD risk model created by Sonoma State University researchers; USGS topographic map backgrounds, and other background spatial data.
- USDA-FS annual aerial SOD surveys, delineating boundaries of forest mortality. On the OakMapper, the data for 2001-2006 is listed under “Aerial Survey Data”. The data is also online in a Google Earth interface at USDA-FS website (<http://www.fs.fed.us/r5/spf/fhp/fhm/aerial/2005/2005kmz.shtml>).
- search and query functions that allow the user to zoom in/out, gain additional information about something on the map by “identifying” or “finding,” and search for SOD near your address. Climate data can also be accessed behind each of the SOD confirmations, and exporting as well as printing custom map options are available.
- a user survey button on the toolbar, where OakMapper feedback and suggestions can be submitted.
- access to SOD confirmations with Google Maps interface and data as the backdrop. Click on “Map” to view the map backdrop, “Satellite” to view aerial and satellite photos as backdrops, and “Hybrid” to view both.
- access to SOD confirmations and additional data layers over the Google Earth interface. It is necessary to install Google Earth (free) onto your computer before this particular data can be viewed. Once it is installed, click on the link on OakMapper.org and open the file in Google Earth. Zoom around and tilt the earth to see a bird’s eye view of SOD. In some places, you can even see the affected dead/dying trees behind the SOD confirmation.
- the ability to report a tree with SOD. Submissions that include an address, intersection, or GPS coordinates are then mapped on the OakMapper. This should coincide with the contacting of your county’s Agricultural Commissioner’s Office (Contact information is available at: <http://www.suddenoakdeath.org/>).

Also coming soon to OakMapper will be the addition of general SOD areas in California, as delineated by SOD experts. The intention of this new data layer will be to depict general boundaries of areas affected by the disease, and will not show absolute locations of individual trees affected.

We encourage you to visit the OakMapper at <http://www.oakmapper.org/>, submit a “SOD Sighting” if you have seen a symptomatic tree, and contribute to the “User Survey” which will help to improve the OakMapper.

PHYTOPHTHORA KERNOVIAE

A final summary report on “Determining the susceptibility of key/dominant UK heathland species to *Phytophthora kernoviae*” has been published by the UK’s Central Science Laboratory (funding was provided by DEFRA). To view the report in its entirety, go to the DEFRA website at: <http://www.defra.gov.uk/planth/kernovii/kernrep.pdf>.



Summary: The susceptibility of eight commonly occurring heathland species to the recently described pathogen *P. kernoviae* (Brasier *et al.*, 2006) was tested. Larger leaved species such as *Vaccinium vitis-idaea*, *V. myrtillus* and *Arctostaphylos uva-ursi* were highly susceptible; the pathogen killing both leaves and stems. Smaller-leaved species such as heathers and heaths, e.g. *Erica cinerea*, *E. tetralix*, and *Calluna vulgaris* were less susceptible, showing limited infection when the plant was wounded prior to inoculation. The sporulation potential of these smaller-leaved varieties was, however, significantly greater than the more susceptible plant species.

PERSONNEL

Sonoma County is seeking a qualified applicant for a full-time one year limited-term vacancy in the U.C. Cooperative Extension office for a Senior Agricultural Program Assistant. The focus of this new position is to address the increased levels of Sudden Oak Death (SOD) throughout the County by coordinating the county-wide SOD program. Under general supervision, the Senior Agricultural Program Assistant will perform or coordinate a variety of tasks to assist academic staff in the development, implementation, and management of agricultural and natural resource projects. Duties will include: focusing on research and education activities; collecting, compiling, and analyzing research trial data; producing written reports of findings; assisting Advisors in a variety of tasks, including, but not limited to, serving as lead coordinator for the Sonoma County SOD program; conducting a needs assessment in Sonoma County regarding SOD research and educational efforts; conducting a SOD educational program in Sonoma County; developing a sampling and monitoring program in cooperation with local agencies and the California Oak Mortality Task Force (COMTF); facilitating groups and working closely with other city, county, state, and federal agencies working on similar research, education, or public service projects; building a good working relationship with other public and private agencies; establishing and maintaining experimental test plots and applying pesticides, fertilizers, and other treatment materials as needed; collecting and analyzing plant, soil, water, and other samples for various constituents; compiling and analyzing sample data; speaking publicly regarding research findings and educational outreach efforts, and other duties as required. For more information and application materials, visit <http://www.sonoma-county.org/> or search "Sonoma County employment."

CALENDAR OF EVENTS

10/9 – 12 – 6th California Oak Symposium, titled “California’s oaks: Today’s challenges, tomorrow’s opportunities;” The conference features a field trip and two indoor sessions on Sudden Oak Death, and is intended for academics, planners, conservation practitioners, foresters, arborists, land owners, and oak enthusiasts. For more information, visit the Symposium website at: <http://danr.ucop.edu/ihrmp/symposium.html>.

10/19 – Christmas Tree *P. ramorum* Research Field Tour; Gary Chastagner and staff will provide growers an opportunity to examine trees with different *P. ramorum* symptoms, discuss the results of their research and discuss potential



- ways to manage *P. ramorum* on Christmas trees; 1:00 p.m.; Black Road Christmas Tree Farm; 19749 Black Rd; Los Gatos, CA 95033; For more information, go to the CA Oak Mortality (COMTF) website at: www.suddenoakdeath.org or contact Janice Alexander at: JAlexander@co.marin.ca.us.
- 10/30 – Free all day Nursery Training Session; Riverside County Department of Agriculture;** Begins at 9:00 a.m.; More information will be forthcoming on the COMTF website at: www.suddenoakdeath.org.
- 10/31 – Free all day Nursery Training Session; Los Angeles County Department of Agriculture;** Begins at 10:00 a.m.; More information will be forthcoming on the COMTF website at: www.suddenoakdeath.org.
- 11/1 - Call for Papers deadline for the Sudden Oak Death Science Symposium III in Santa Rosa, CA (March 2007);** for more information, go to the Symposium website at: <http://nature.berkeley.edu/comtf/sodsymposium/>.
- 11/6 – 9 – 2006 Annual Gypsy Moth Review; St. Louis, MO; *P. ramorum* will be presented in the afternoon of 11/8.** For more information, visit: <http://www.uky.edu/Ag/NurseryInspection/agmr2006.htm>.
- 11/14 – 15 – 2006 Annual Meeting of the CA Forest Pest Council; Heidrick Agricultural History Center;** 1962 Hays Lane; Woodland, CA; An update on SOD and efforts to control *Phytophthora lateralis*, *P. ramorum*, and a *P. cinnamomi* on a rare Manzanita will be presented; For more information, contact Mike Bohne, USDA-FS, at: mbohne@fs.fed.us.
- 3/5 -3/9/2007 - Sudden Oak Death Science Symposium III; Hyatt Vineyard Creek Hotel and Spa;** 170 Railroad Street; Santa Rosa, CA 95401; Additional information will be forthcoming. For questions, contact Katie Palmieri, CA Oak Mortality Task Force Public Information Officer, at: palmieri@nature.berkeley.edu or (510) 847-5482.