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Please reply to Susan Frankel, Maggi Kelly and Wally Mark by April 25.

California's 2003 Monitoring Program for *Phytophthora ramorum,* cause of Sudden Oak Death

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California Oak Mortality Task Force

Phytophthora ramorum, cause of Sudden Oak Death, has been identified on 26 plant species in 12 California counties as well as a limited region near Brookings, Oregon, where eradication efforts are underway. The pathogen has also been found in nurseries in 10 European countries.

In 2003, California's Monitoring Program for *Phytophthora ramorum* will continue to be coordinated through the California Oak Mortality Task Force with funding primarily from the USDA Forest Service, California Department of Forestry and Fire Protection, and California Department of Food and Agriculture. California's comprehensive *Phytophthora ramorum* monitoring program is maintained by Maggi Kelly, UC-Berkeley, and can be found under "monitoring" at www.suddenoakdeath.org.

California's 2003 *Phytophthora ramorum* monitoring priorities are:

1. **Early detection.** Survey efforts will focus on Del Norte, Humboldt, and Mendocino Counties; the Sierra Nevada Foothills; and San Luis Obispo County.

2. **Improvement of diagnostic techniques, field guides, and disease identification resources.**

Determination of pathogen distribution within counties known to be heavily infested with *Phytophthora ramorum* will not be a priority, as resources are insufficient to develop detailed maps of these areas.

Sudden Oak Death management programs and policies need current disease distribution and trends, as federal and State quarantines are based on such information. In Oregon, attempts are underway to eradicate *Phytophthora ramoru*m, making early detection, and possibly eradication, of Northern California infestations critical to prevent further pathogen spread into Oregon. There have also been *Phytophthora ramorum* DNA recoveries from the foothills of the Sierra Nevada, but a viable culture has never grown from suspected samples. Determining the presence or absence of the disease in the foothills is vital for natural resource managers as well as regulators for disease suppression.

Planned Activities:

Monitoring

Aerial surveys of counties that border on the 12-county infested area. All 16 counties bordering the known infested area will be aerially surveyed for tree mortality. Ground checking of noted areas will be prioritized, with North Coast counties, in addition to San Luis Obispo County, being given highest priority. The project will be completed by Lisa Levien and Jeffrey Mai, USDA Forest Service, as well as Walter Mark, Cal Poly, San Luis Obispo. The $188,000 budget will be funded by USDA Forest Service ($125,000) with a match from the State ($63,000).

Targeted surveys for *Phytophthora ramorum* in Northern California, coastal national forests, and the Sierra Nevada Foothills. The risk model for *Phytophthora ramorum*, done by Ross Meentemeyer, Sonoma State University, will be fine-tuned and used to identify areas likely to become infested. A sample of the high-risk sites will be ground-checked to calibrate the risk model and determine if *Phytophthora ramorum* is present. The project will be completed by Ross Meentemeyer and Walter Mark. The $136,000 budget will be funded by the California Department of Forestry and Fire Protection ($66,000) and USDA Forest Service ($70,000)

***Phytophthora ramorum* surveillance by Forest Inventory and Analysis (FIA) crews.** *Phytophthora ramorum* will be checked for in California on all FIA plots visited in 2003. Prior to surveillance, *Phytophthora ramorum* identification and sampling training will be provided for inventory crews. Funding for sampling, shipping, and handling will be provided by the USDA Forest Service to Pacific Northwest Research Station ($10,000).

Early detection through watershed monitoring. The goal of this work is to develop methodologies to monitor streams and rivers for *Phytophthora ramorum*. The rationale is that streams provide a means to sample inoculum from a large area and studies would be simpler to design than ground based surveys. Previous work has shown that *Phytophthora ramorum* can be baited from stream water in forested areas that have the disease. With seasons

affecting foliage and soil sampling success, water sampling may allow for greater temporal flexibility in monitoring. This project aims to sample major watersheds in the coastal range of California where *Phytophthora ramorum* is found. Monitoring will range from south of the Big Sur area to the Oregon border. Mesh bags with bait (e.g., rhododendron leaves) will be placed in stream water for one week, then removed and taken to the lab, where the bait will be plated on selective media. Watersheds known-to-be-infested with *Phytophthora ramorum*, as well as watersheds thought to be free-from infestation, will be monitored. In watersheds known-to-be-infested, experiments will be conducted to determine how far downstream *Phytophthora ramorum* can be detected and how stream detection correlates with stand infection. This information can then be used to determine how to design ground-based surveys if the stream survey detects *Phytophthora ramorum* in a watershed considered to be uninfested. David Rizzo, UC-Davis, will conduct the study. Funding will be provided by the USDA Forest Service ($70,000) with matching funds from the State.

Survey methods evaluation. Don Owen, CDF, and Susan Frankel, USDA Forest Service, in cooperation with Rizzo, Maloney, and Davidson, UC-Davis, will evaluate several survey protocols in permanent plots with known infection levels. Variation based on sample intensity, time of year, and surveyor skill-level will be evaluated.

Spatial dynamics of oak mortality. Using high-resolution imagery from 2000, 2001, and 2002, oak mortality will be mapped through time and environmental correlations will be made to disease spread in China Camp State Park, CA, and Marin Municipal Water District, Marin, CA. Maggi Kelly, UC Berkeley, will complete this project using $36,000 from the California Department of Forestry and Fire Protection.

Diagnostics: field and laboratory support

SOD spatial database support. All spatial data describing locations of *Phytophthora ramorum* confirmations will continue to be maintained at the Center for the Assessment and Monitoring of Forest and Environmental Resources (CAMFER), UC Berkeley. Data will be accessible to the public, regulators, scientists, and all interested parties via WebGIS, static maps, and text descriptions. Maggi Kelly will maintain this information using $60,000 from the California Department of Forestry and Fire Protection.

Field sample collection and lab diagnostic services in uninfested counties. The California Department of Food and Agriculture (CDFA) will continue to fund a *Phytophthora ramorum* diagnostic lab. In addition, uninfested counties with field samples will be analyzed by the Garbelotto lab (UC Berkeley) for PCR methods and the Rizzo lab (UC Davis) for cultural isolation. All three labs assist in training on pathogen recognition and sampling. Funding for the Rizzo lab will come from USDA Forest Service

($85,000) with an additional $60,000 from the California Department of Forestry and Fire Protection for field sample collection and follow-up to reports of significant new finds. Funding for the Garbelotto lab will come from USDA Forest Service ($85,000).

Enhancement of CDFA laboratory PCR technique. Unlike the Garbelotto lab, the PCR techniques used by the CDFA lab are not sensitive enough to detect *Phytophthora ramorum* in big leaf maple and several other hosts. CDFA is considering changing techniques and needs to evaluate those used by Garbelotto. Adoption of Garbelotto's methods will enhance the utility of CDFA's lab, thereby providing a second lab for comparison of results. The change will require the purchase of supplies and materials as well as increase labor demands for comparison runs and quality control. USDA Forest Service ($25,000) will fund the project with matching funds from the State.

Publication of common California oak pests. Mortality due to Sudden Oak Death has increased awareness of native oaks as an important resource in the California landscape and has led to more inquiries about arthropod pests and diseases that may affect the health of native oaks. The California Oak Disease and Arthropod (CODA) database is the most comprehensive source of information on agents that impact oaks in California. A web-based interface for CODA is currently under development with USDA Forest Service funding. While CODA serves the needs of some users, a short, printable oak pest reference is also needed for many urban forestry professionals. The information in CODA will be used to produce a short publication on the most common, important, and/or most conspicuous pests of native California oaks. Host range, diagnosis/identification, impact on the host(s), and biology of the agent will be included in the publication. It will cover agents that affect acorns, leaves and twigs, large stems and trunks, and the root crown and roots. In all, about 20 groups of agents will be covered. Ted Sweicki, Phytosphere Research, will complete the project with funding from the USDA Forest Service ($18,000).

Training. An important component of the monitoring program is training natural resource and horticultural professionals in disease recognition and how to report suspect new areas. The California Oak Mortality Task Force has three recognition, sampling, sanitation, and regulatory compliance courses planned in 2003: March 19 in Santa Cruz County, April 30 in Humboldt County, and May 29 in Sonoma County. The cornerstone to California's *Phytophthora ramorum* monitoring program is cooperation among counties, state agencies, and federal officials.

Monitoring in horticultural nurseries. Studies will be carried out to support the development of protocols for monitoring horticultural nurseries for *Phytophthora ramorum*. Protocols for bulk potting mix, potting mix in containers, and plants will be developed. This project will be funded by the State ($40,000) and federal government ($40,000).