



CALIFORNIA OAK MORTALITY TASK FORCE

CRITICAL SUDDEN OAK DEATH/*PHYTOPHTHORA RAMORUM* RESEARCH NEEDS

Current situation. Sudden oak death (SOD) control in wildlands eludes us despite the numerous suppression and eradication projects that have been attempted since 2000. Research to date has resulted in a better understanding of *Phytophthora ramorum* (cause of SOD), its hosts, modes of spread, and persistence in soil and water, and land managers and researchers continue to work cooperatively to treat (i.e., remove and/or spray) high-priority infestations in an effort to stop or slow disease progression. In spite of these determined efforts, California and Oregon have lost well over 3 million trees, of which more than 500,000 were killed in the past 2 years alone as the pathogen spreads to new locations.

Worldwide, *P. ramorum* has killed over 5 million trees and is known to infect more than 130 plant species, including rhododendron and camellia as well as other popular landscape plants. Forest, horticultural, and agricultural resources are at significant risk from this exotic, quarantine organism. Research is urgently needed to develop **effective landscape treatment strategies** and prevent new infestations.

The threat from SOD and *P. ramorum* is greater than ever, as scientific evidence demonstrates that if we do nothing, millions more tanoak and coast live oak trees in California and Oregon coastal forests will die. The threat to eastern hardwood forests is high as there are numerous susceptible hosts in suitable habitats. All current management techniques have had limited success in slowing pathogen spread. SOD is adjacent to vital tribal traditional gathering areas and high-value timber lands, and quarantines threaten lily bulb and other horticultural industries in Del Norte County, which would be prohibited from shipping if the pathogen continues to spread northward.

Critical Research Needs

- **Determine the effectiveness of silvicultural approaches to build stand resilience and slow pathogen spread.** North Coast land managers (Green Diamond, the Six Rivers National Forest, Bureau of Land Management, Tribes, and others) are currently thinning stands to shift species composition and density to decrease the likelihood of *P. ramorum* establishment in new areas. Funds are needed to determine if silvicultural treatments are effective and to calibrate prescriptions for various topographical and environmental conditions.
- **Develop reforestation guidelines for land managers and homeowners.** Many Bay Area forests have been under attack from *P. ramorum* for more than 20 years. Cumulative damage has created large openings and high fuel loads in wildland urban interface areas. Greenhouse gas capture has been reduced. Restoration trials are needed to determine how to mitigate for the ecological impacts of SOD, reduce fuels, and increase carbon capture as well as enhance other desirable stand characteristics.

- **Develop resistant tanoak planting stock.** Since there are currently no effective, practical wildland treatments to protect tanoak from SOD, resistant trees need to be developed as a management option for restoration.
- **Evaluate phosphite preventive treatments and develop novel curative treatments.** To prevent *P. ramorum* infection of high-risk trees, phosphite (Agri-Fos® and other trade names) is applied to tanoak and oak trees via spray or injection. In California, phosphite application effectiveness on mature trees is variable. Research is needed to determine how well and under what conditions phosphite works and if phosphite application/delivery methods can be improved to obtain greater levels of activity. Other curative treatments also need to be developed.
- **Identify the risks of *P. ramorum* establishment on larch in the US.** The location of Japanese larch (*Larix kaempferi*), European larch (*L. decidua*), and native western larch (*Larix occidentalis*) trees in the US needs to be determined, and trees in pathogen-conducive environments or near nurseries with *P. ramorum*-positive detections need to be surveyed.
- **Analyze pathogen genetics to reveal pathways of movement.** Genetic fingerprinting of isolates from nursery and forest detections is needed to understand spread patterns and determine if regulations (quarantines) and management activities are effective. This analysis is also essential to determine whether new lineages have become established in the US and if different lineages are commingling and at risk for hybridization. A fourth lineage was identified in 2012 in the UK, indicating continued introductions despite quarantines.
- **Develop strategies to prevent contamination and decontaminate water.** There are 12 infested rivers in the southeast and more in the Pacific Northwest, nearly all of which have been contaminated via run-off escaping nurseries and moving into nearby landscapes and forests. Environmentally safe pesticides, filters, and other treatments need to be developed to sanitize infested water. Effective preventive measures to reduce run-off are also needed.
- **Develop methods for early detection.** The pathogen can only be eradicated if infestations are detected early. Monitoring methods for early detection via air, water, and soil need refinement.
- **Determine the economic, ecological, and social impacts of SOD/*P. ramorum*.** Impacts need to be accurately quantified for informed decision making.
- **Determine the spread risks associated with moving naturally infested soil and water from wildland infestations.**

Research Coordination and Delivery

The California Oak Mortality Task Force website (www.suddenoakdeath.org) provides information on *P. ramorum* diagnosis and management in California. Funding is needed for website maintenance, interagency coordination, education, and outreach.

For more information, contact Katie Palmieri at kpalmieri@berkeley.edu or (530) 350-7147.