

Detection and Eradication of *Phytophthora ramorum* from Oregon Forests, 2001-2008¹

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Abstract

Sudden oak death (SOD), caused by *Phytophthora ramorum*, was first discovered in Oregon forests by aerial survey in July 2001. Since then an interagency team has been working with landowners to eradicate the pathogen by cutting and burning all infected and nearby host plants. The Oregon SOD program now consists of the following elements: early detection; delimitation of infested areas; treatment; research and monitoring; and host reduction in areas of probable disease spread.

Early detection relies heavily on aerial surveys (fixed and rotary wing aircraft) to detect recently killed trees, followed by inspection and sampling of all trees spotted from the air. Ground-based surveys (scouting from vantage points or transect-based surveys) compliment the aerial surveys in that they allow detection of infected trees in early stages of symptom development that would not be visible from the air. Stream baiting with rhododendron (*Rhododendron* spp.) and tanoak (*Lithocarpus densiflorus*) leaves has been a useful early detection tool, and in seven watersheds has detected *P. ramorum* before infected plants were found in the watershed. Fifty-eight streams in and near the Oregon quarantine area in the southwest corner of the state are currently monitored for *P. ramorum*. The collective results from these surveys clearly suggest that *P. ramorum* does not occur in Oregon forests beyond the Curry County quarantine area.

Eradication treatments consist of cutting and burning all infected and nearby host plants as soon as possible after detection. During the first 2 years of the eradication effort, all host vegetation within 15 to 30 m of infected plants was destroyed. In subsequent years, this distance was increased to a minimum of 30 to 100 m, reflecting observations on spread of the pathogen. On private and U.S. Department of Agriculture, Forest Service (USDA FS) land, all tanoaks are injected with herbicide (imazapyr or glyphosate) prior to cutting in order to prevent stump sprouting following treatment. In recent years, tanoak also has been removed in areas of likely disease spread in order to disrupt spread of the pathogen across the landscape. We expect to expand this effort in 2009 and 2010 with funds from the American Recovery and Reinvestment Act of 2009.

During the first 4 years of the eradication effort, the number of new infested sites and infected trees remained steady or decreased each year, indicating modest success at containment and

¹ A version of this paper was presented at the Fourth Sudden Oak Death Science Symposium, June 15-18, 2009, Santa Cruz, California.

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eradication. That trend ended in 2005 when the number of new infected trees and the area infested began increasing. Since then, delays in completing treatments and consecutive years of unusually wet spring and early summer weather have contributed to spread of the disease, forcing the expansion of the quarantine zone from 6734 ha to 41956 ha in 2008. In 2007 and 2008 we found approximately 60 new infested sites each year (fig. 1, fig. 2).

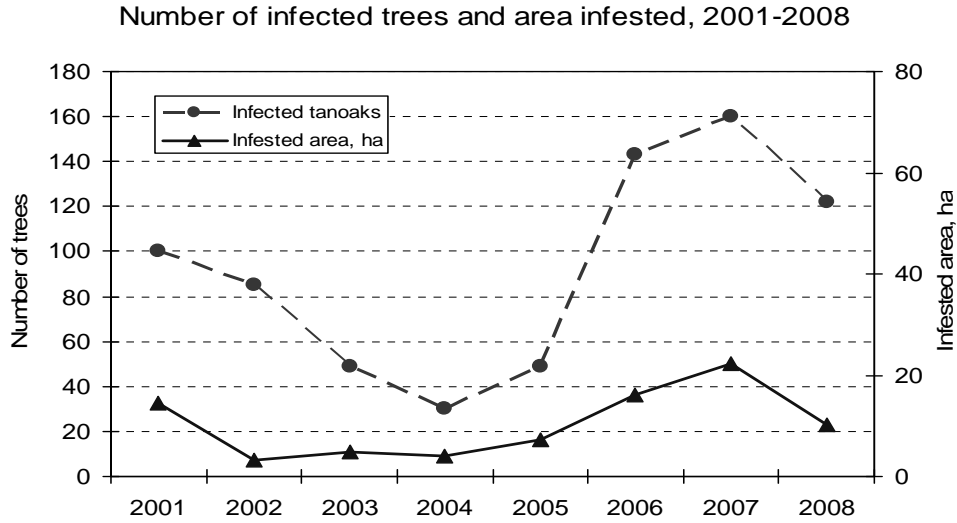


Figure 1—Sudden oak death trends in southern Curry County, Oregon, 2001 to 2008.

Between 2001 and the end of 2008 we completed eradication treatments on approximately 960 ha of forest at a cost of \$4.3 million. Fund sources included the USDA FS (50 percent), State of Oregon (34 percent), U.S. Department of the Interior, Bureau of Land Management (USDI BLM) (10 percent), and U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS) (6 percent). There is no compensation to landowners for the value of timber or other resources lost as a result of the eradication treatments.

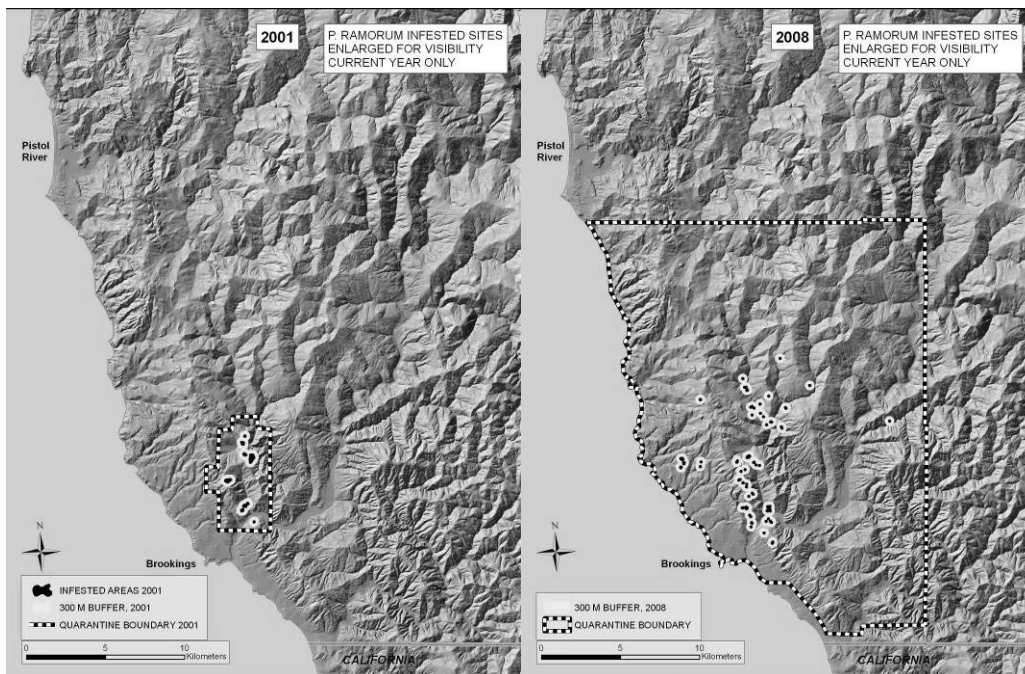


Figure 2—Location of areas infested with *P. ramorum* in southwest Oregon in 2001 and in 2008. Sites enlarged by a 300 m radius halo for visibility. White dashed line indicates quarantine area.

Research and monitoring during the past few years have yielded valuable information about the disease and its management in Oregon forests. Tanoak clearly is the most important host species in Oregon for two reasons; it is most susceptible and readily killed by the pathogen, and it appears to be essential for disease spread. We have found *P. ramorum* in forests only in association with infected tanoaks. Baiting rainfall collection buckets during various stages of the eradication process indicates that: 1) *P. ramorum* inoculum is available during rain events throughout the year; 2) inoculum is not generally distributed in the Curry County quarantine area, and; 3) inoculum is produced near infected trees before and during treatment, but not near the perimeter of the treatment areas or in apparently healthy stands.

Assaying soils and vegetation following eradication treatments has shown that *P. ramorum* is recoverable from soil on fewer than 50 percent of treated sites and is rarely found infecting plants. The lack of disease on treated sites suggests that the treatment is effective in most cases. Aerial application of Agri-Fos[®] is being tested as a means to disrupt disease spread, and results thus far indicate that aerially applied Agri-Fos[®] does have an affect on growth of the pathogen in treated trees.

To date we have had modest success at eradication and very good success at limiting spread and containing the pathogen to a relatively small area, thereby reducing damage to forests and minimizing the economic impact of quarantine regulations. Continued spread of *P. ramorum* despite the eradication effort is attributable in large part to latency of the pathogen in infected tanoak trees which allows pathogen spread between the time of initial infection and detection of symptoms. Administrative obstacles and inconsistent funding often extend the interval between detection of an infected tree and completion of eradication treatments, providing additional time for pathogen spread. These delays must be eliminated in order to improve effectiveness of the program.