



Figure 6—Employees from the Maryland Department of Agriculture's Plant Protection and Weed Management Division (left) and APHIS' Plant Protection and Quarantine program collect leaf samples from rhododendrons during a national survey for *P. ramorum* in nurseries. (APHIS photo by R. Anson Eaglin)

APHIS has enacted strict regulations in 15 counties along the California and Oregon coastline because *P. ramorum* causes significant disease in those forest environments. For nurseries, preventing the introduction and establishment of the diseases *P. ramorum* causes is the best defense.

## How You Can Help

If you suspect that shrubs or other plants are infected with *P. ramorum*, please contact your local extension specialist or State plant regulatory official. To locate an extension specialist near you, go to



Figure 7—An APHIS plant health safeguarding specialist flags sampled rhododendrons for destruction should they prove positive for *P. ramorum*. (APHIS photo by R. Anson Eaglin)

USDA's Cooperative State Research, Education, and Extension Service Web site at [www.csrees.usda.gov/Extension/index.html](http://www.csrees.usda.gov/Extension/index.html), or consult the blue pages of the telephone book under "U.S. Department of Agriculture, Cooperative State Research, Education, and Extension Service." A directory of State plant regulatory officials is available on the National Plant Board Web site at [www.nationalplantboard.org/member/index.shtml](http://www.nationalplantboard.org/member/index.shtml).

For more information and resources concerning *P. ramorum*, visit APHIS' Web site at [www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/pram/index.shtml](http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/index.shtml) ■



Figure 8—Agricultural officials survey for the pathogen in areas surrounding nurseries. Here, leaf and branch samples are collected from a maple tree. (APHIS photo by R. Anson Eaglin.)



United States Department of Agriculture  
Animal and Plant Health Inspection Service

# Phytophthora ramorum: Stopping the Spread

Program Aid No. 1842

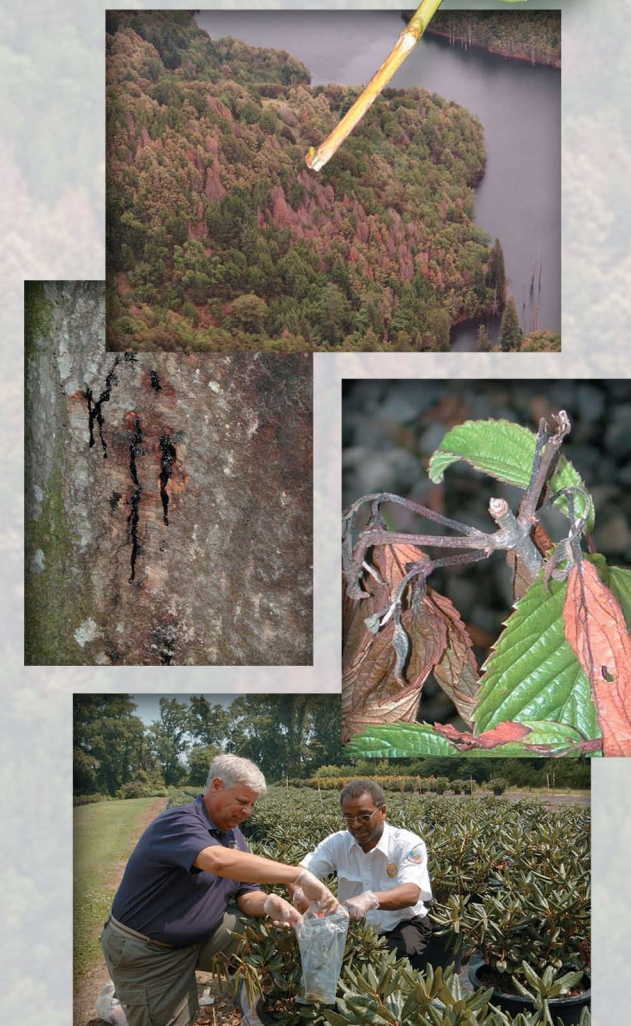


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Cover photos [top to bottom]: An aerial view of Kent Lake, CA, woodlands infected with the sudden oak death pathogen, *Phytophthora ramorum*. The trunk of this infected live oak exhibits bleeding cankers caused by *P. ramorum* infection. Viburnum, a popular nursery shrub, is susceptible to sudden oak death. (APHIS photo by R. Anson Eaglin.) Federal and State cooperators survey for evidence of *P. ramorum* nationwide. *Camellia* and *Rhododendron* as well as *Pieris* and *Kalmia* are also susceptible to *P. ramorum* infection.

*Photo credits:* Captions indicate the source of all photographs used in this leaflet. APHIS gratefully acknowledges the cooperation of cited sources in furnishing images for use in this publication.

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## Background

In 1995, a mysterious and sometimes lethal plant pathogen was detected for the first time in the woodland environment of Marin County, California. Over the next several years, foresters, conservationists, plant pathologists, and the general public noticed that trees were dying in large numbers along the northern California coast. The pathogen infected and eventually killed coast live oaks, California black oaks, canyon live oaks, Shreve's oaks, and more than 1 million tanoaks.



Figure 1—This aerial view shows tree death in Kent Lake, CA, woodlands infested with the sudden oak death pathogen, *Phytophthora ramorum*. (Photo supplied by the Oregon Department of Agriculture and reproduced by permission)



Figure 2—The trunk of this *P. ramorum*-infected coast live oak exhibits the bleeding cankers associated with sudden oak death. (Photo by Bruce Moltzan, USDA Forest Service)

It wasn't until 2001 that scientists identified the pathogen as a water mold they named *Phytophthora ramorum*. This fungus is now known to cause three plant diseases—sudden oak death, ramorum blight, and ramorum dieback.

*P. ramorum* was first observed in Germany and the Netherlands in 1993. It has since been detected in nurseries in most European countries and the Canadian province of British Columbia. Since the fungus was identified and named in 2001, nursery stock has been found infected in over half of the U.S. States.

*P. ramorum* has a broad range of hosts, including hardwoods (e.g., coast live oak), softwoods (e.g., Douglas-fir), and landscape plants (e.g., camellia and rhododendron). More than 100 plant species and cultivars representing more than 70 genera are susceptible to *P. ramorum*. Some may succumb to the disease, whereas others facilitate the spread of the fungus. Although herbaceous plants are also susceptible to infection, it is rare that they show signs of the disease.



Figure 3—Rhododendron, a common nursery plant, is one of more than 70 plant species and cultivars susceptible to *P. ramorum*. (Photo by Jennifer Parke, Oregon State University; reproduced by permission)

## Plants Naturally Infected With *P. ramorum*

Plants in the following genera are vulnerable to infection by *P. ramorum*:

- *Lithocarpus* (tanoak)
- *Quercus* (oak)
- *Camellia*
- *Rhododendron*
- *Viburnum*
- *Pieris*
- *Kalmia* (mountain laurel)
- *Umbellularia* (California bay laurel, Oregon myrtle).

To learn more about other plants susceptible to *P. ramorum*, please visit the APHIS Web site at [www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/pram/index.shtml](http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/index.shtml).



Figure 4—These camellia leaves show *P. ramorum*-induced leaf spot. (Photo by Cheryl Blomquist, California Department of Food and Agriculture; reproduced by permission)

## Movement and Infection in Plants

*P. ramorum* thrives in cool, wet climates, but significant infestations can occur in much warmer, drier conditions when nurseries create microclimates that foster the fungus. *P. ramorum* is known to spread through infected plants and wind-blown rain, as well as contaminated irrigation water, soil, or gravel substrates. The fungus can also be moved unknowingly in used pots or contaminated potting mix.

Depending on the plant species, *P. ramorum* infections may occur on the trunk, branches, leaves, or twigs. Calluses, referred to as cankers, can develop when infections occur on a tree's woody tissues. In foliar and twig hosts, symptoms can range from leaf spots to twig dieback, but these hosts rarely die from the infection. Symptoms caused by *P. ramo-*

*rum* are difficult to differentiate from those caused by other pathogens. For this reason, laboratory analysis is necessary to confirm its presence.

## Stopping the Spread

In 2004, regulators discovered that *P. ramorum* had moved nationwide on infected hosts, the most common of which were several varieties of camellia and rhododendron plants. Since then, regulatory inspections and certification procedures have helped to minimize the risk of infested shipments.



Figure 5—Nurseries can be a pathway for the spread of *P. ramorum*. (APHIS photo by Jim Writer)

APHIS' goal is to stop the spread of *P. ramorum* through regulations and a public outreach program. APHIS works with other Federal agencies, States, conservationists, and the nursery industry to limit the human-assisted spread of *P. ramorum* in the United States by inspecting nurseries for infected plants and plant material. This team of experts regulates nursery stock of all host plants from California, Oregon, and Washington to address risks and reassure markets. As a result, more than 1,000 nurseries growing host plants in these three States are now inspected, sampled, and tested every year for the presence of *P. ramorum* so that they may be certified to ship plants to other States.