



# ***Phytophthora ramorum:*** cause of sudden oak death and other diseases

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University of California Cooperative Extension  
Oregon State University  
USDA-Animal and Plant Health Inspection Service  
California Oak Mortality Task Force  
USDA-Forest Service



# Overview

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- History & description of *P. ramorum*
- *P. ramorum* in wildlands
- *P. ramorum* in nurseries & landscaping
- Regulations
- Best Management Practices: IPM
- Research update
- Communication & education
- Questions & answers



# Speakers

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- Janice Alexander, Sudden Oak Death Outreach Coordinator, University of California Cooperative Extension
- Jennifer Parke, Plant Pathologist, Oregon State University
- Jonathan Jones, National *Phytophthora ramorum* Program Manager, USDA APHIS PPQ

# History of *Phytophthora ramorum* in North America





Marin County, CA (north of San Francisco)

Photo: Marin County Fire Department



**Marin County, CA (north of San Francisco), 2000**

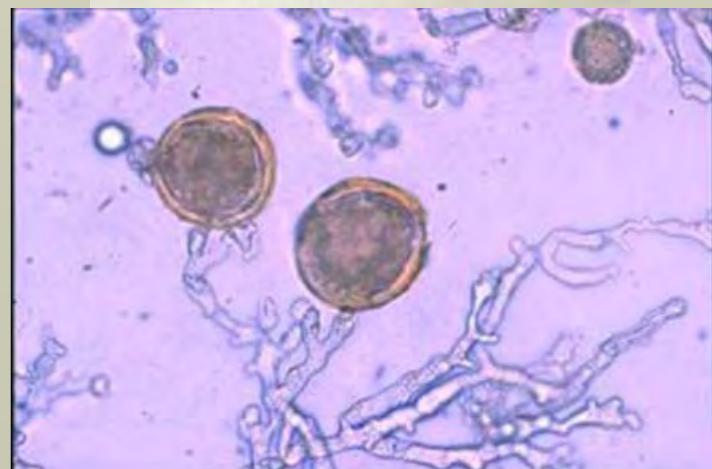
Photo: Marin County Fire Department

# *Phytophthora ramorum*



*Phytophthora ramorum* in culture

Sporangia releasing zoospores



Chlamydospores

# European garden & nursery finds



*Phytophthora ramorum* infection on rhododendron in Europe



*Phytophthora ramorum* infection on the leaves of California bay laurel (*Umbellularia californica*)

Photo: Joseph O'Brien, USDA-Forest Service

# Two sets of symptoms caused by *Phytophthora ramorum*

- Sudden Oak Death
  - Red oak group hosts and tanoak
  - Stem lesions beneath the bark
  - May bleed or ooze
  - Can kill adult plants
- *Phytophthora ramorum* Foliar Blight
  - Non-oak hosts
  - Spots and blotches on leaves
  - Shoot dieback
  - Can kill juvenile plants, occasionally mature plants



Photo: Mike McWilliams, ODF

## Distribution of Sudden Oak Death as of December 12, 2005



Map produced on 12/12/05 by UCB G1F: <http://kellylab.berkeley.edu/SODmonitoring/>  
For more information about Sudden Oak Death, please visit the California Oak Mortality Task Force website at [http://www.sudden\)oakdeath.org/](http://www.sudden)oakdeath.org/)



*P. ramorum*  
confirmations in  
North American forests

Map from [www.sudden\)oakdeath.org/](http://www.sudden)oakdeath.org/)  
Kelly, UC-Berkeley

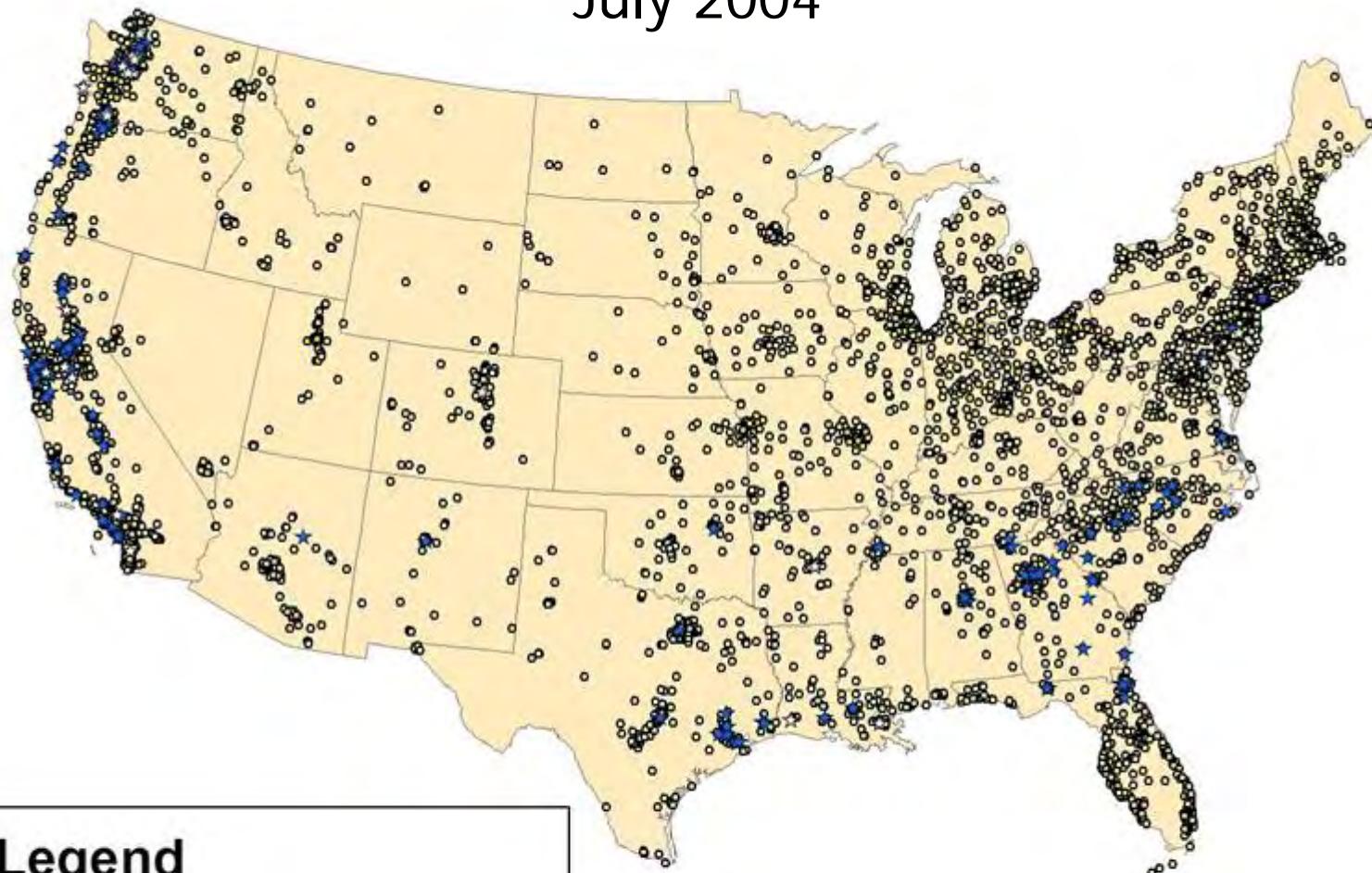


Photo: Jennifer Parke, Oregon State University



Photo: Jonathan Jones, APHIS, PPO

# Trace-forwards and positive detections across the U.S. July 2004



## Legend

- ★ Positive Site
- ★ Hold released
- Trace forward/back zipcode

# Infected trees in Europe



*Fagus sylvatica*



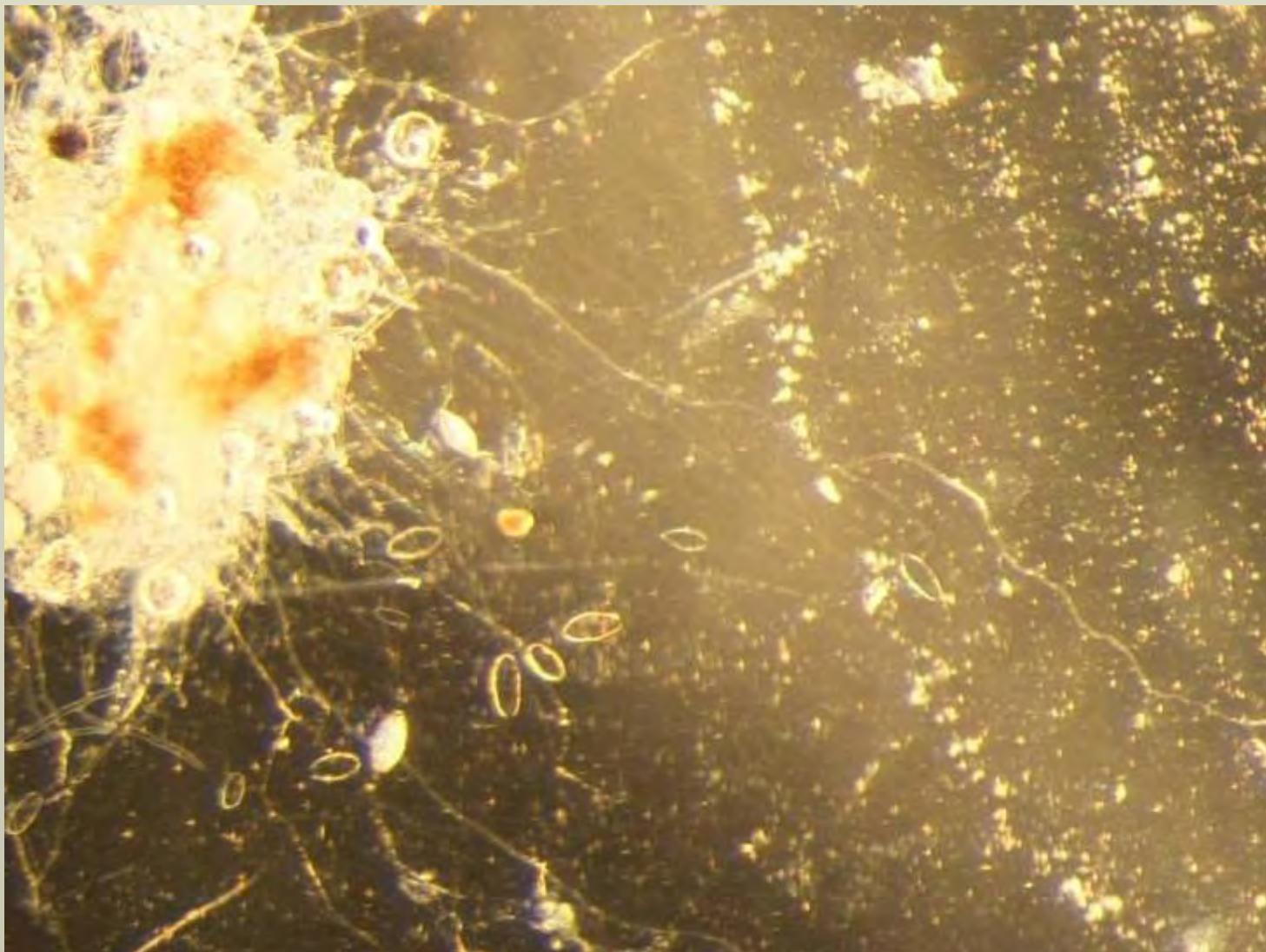
*Quercus rubra*

Photo: DEFRA

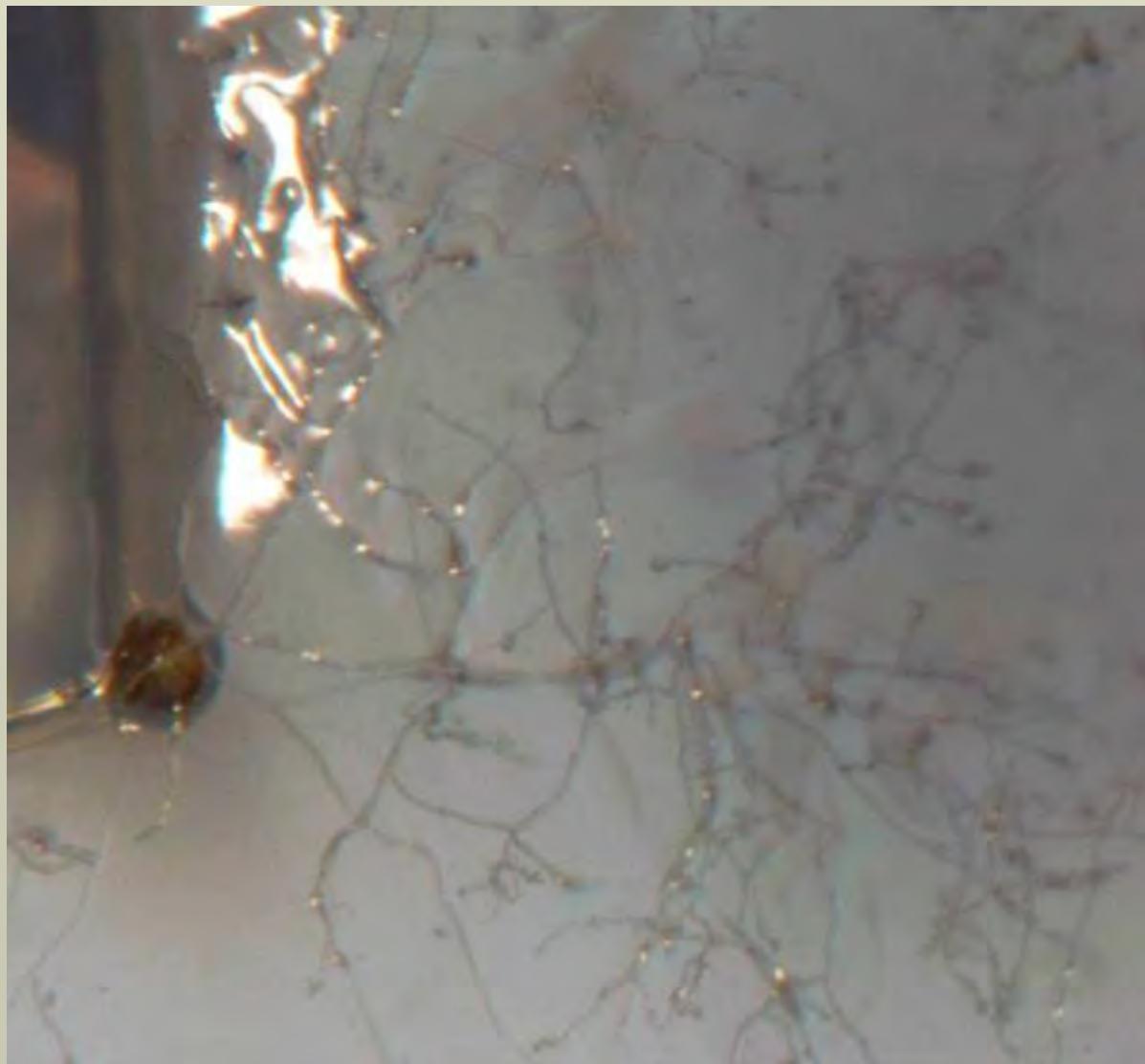
# *Phytophthora species*



# *Phytophthora ramorum*



# *Phytophthora ramorum*





# Susceptible Species\*

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Andrew's clintonia bead lily	Goat willow	Roble beech
Ardisia	Grand fir	Rugosa rose
Bigleaf maple	Griselinia	Salal
California bay laurel	Holm oak	Salmonberry
California black oak	Horse chestnut	Scotch heather
California buckeye	Hybrid witchhazel	Sessile oak
California coffeeberry	Laurustinus	Shreve oak
California hazelnut	Lilac	Southern red oak
California honeysuckle	Madrone	Spicebush
California maidenhair fern	Magnolia varieties	Spreading euonymus
California nutmeg	Manzanita	Star magnolia
California wood fern	Michelia	Strawberry tree
Camellia species	Mountain laurel	Striped bark maple
Canyon live oak	Northern red oak	Sweet bay laurel
Cascara	Oregon ash	Sweet chestnut
Chinese witchhazel	Osmanthus	Sweet Cicely
Coast live oak	Pacific yew	Tanoak
Coast redwood	Persian ironwood	Toyon
Douglas fir	Pieris varieties	Viburnum varieties
Drooping leucothoe	Planetree maple	Victorian box
European ash	Poison oak	Western maidenhair fern
European beech	Portuguese laurel cherry	Western starflower
European turkey oak	Red fir	White fir
European yew	Red tip photinia	Winter's bark
Evergreen huckleberry	Redwood ivy	Witch hazel
Evergreen maple	Rhododendron species	Wood rose
False Solomon's seal		
Formosa firethorn		
Fetterbush		



# *Phytophthora ramorum* in North American Wildlands

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# Symptoms caused by *P. ramorum* differ on different hosts

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Sudden Oak Death  
affects members of the oak family  
(Fagaceae)

- True oaks (*Quercus* spp.)
- Tanoak (*Lithocarpus densiflorus*)
- Chestnut (*Castanea*) [Europe only]
- Beech (*Fagus*) [Europe only]

***P. ramorum* on coast live oak**



# *Phytophthora ramorum*



- 'Bleeding' or oozing on the bark
- Not associated with cracks in bark or insect holes
- Usually on the lower 6 ft. of tree trunks



# *Phytophthora ramorum*



# Other common diseases & injuries



- Bacterial wetwood
- Boring insects
- Mechanical injury
- Fungi

# Similar symptoms – not *P. ramorum*



outer bark



inner bark

Bleeding canker caused by *Armillaria*

# Similar symptoms – not *P. ramorum*



outer bark



inner bark

Bleeding canker caused by inner-bark boring insect

# Similar symptoms – not *P. ramorum*



outer bark



inner bark

Bleeding canker caused by *Inonotus hispidus*

# On other plant hosts, *P. ramorum* causes symptoms of foliar blight

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- Mountain laurel
- Viburnum
- Ferns
- *Vaccinium*
- Conifers
- etc...

# *P. ramorum* symptoms on California bay laurel (*Umbellularia californica*)



# *P. ramorum* symptoms on kalmia (mountain laurel)



# *P. ramorum* symptoms on conifers



Grand fir



Douglas-fir



# Early detection & monitoring

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- Forest Service aerial survey





# Early detection & monitoring

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- Stream baiting





# Early detection & monitoring

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- Ground surveys





# Management Issues

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- Treatment



Photo: Ted Swiecki, Phytosphere Research



# Management Issues

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- Eradication





# Management Issues

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- Suppression





# Management Issues

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- Containment

