

Phytophthora Threats to Native Vegetation: Fighting Back!



Sudden oak death, Ft. Ross, Sonoma Co., Spring 2018

Photo: Chris Lee, CALFIRE

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***Phytophthora* Threats to Native Vegetation: Fighting back!**

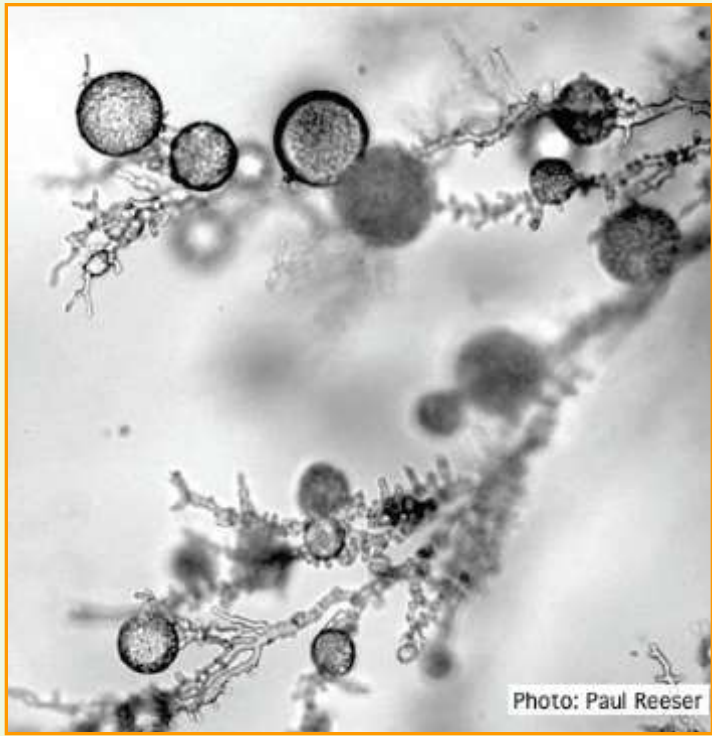
- 1) Overview. *Phytophthora* problems with a focus on native plant nurseries and restoration areas**
 - 2) How organizations are addressing the problem**
-

Key Points...

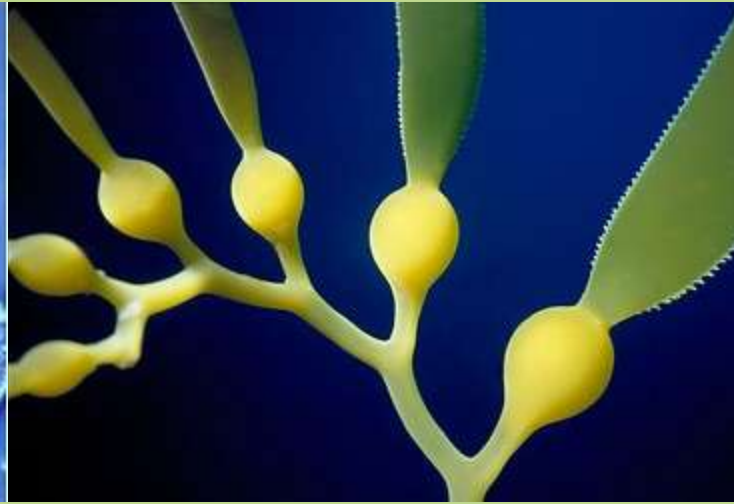
***Phytophthora* introductions are causing irreversible degradation of forests & wildlands.**

- Prevention is key.**

What are *Phytophthoras*?



Photographs: Rizzo, UC Davis & Garbelotto, UC Berkeley



BROWN ALGAE and DIATOMS

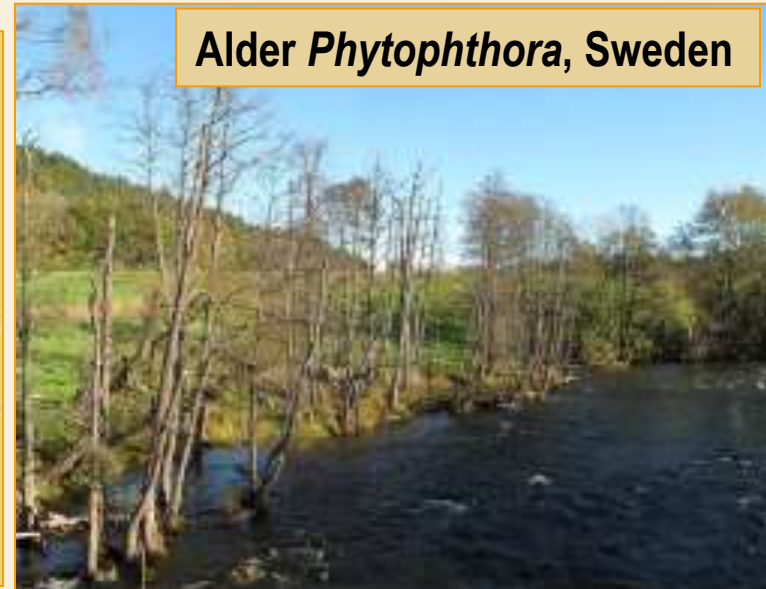


Sogin, Mitchell L. and Patterson, David J. 1995. Stramenopiles. Version 01 January 1995 (under construction). <http://tolweb.org/Stramenopiles/2380/1995.01.01> in The Tree of Life Web Project, <http://tolweb.org/>

Phytophthora tree & plant-killers - worldwide



Phytophthora cinnamomi on oak in Southern Spain



Alder *Phytophthora*, Sweden

Sudden Oak Death, Big Sur, Monterey County, Spring 2018



Credit: Kerry Frangioso, UC-Davis

SOD- Oregon



Photo: USFS, PNW FHP

Phytophthora ramorum on tanoak near Brookings, OR

Manzanita – 9 species as *P. ramorum* hosts

Rainbow manzanita, *Arctostaphylos rainbowensis*



Rare

RAINBOW MANZANITA
(RARE & ENDANGERED)
ARCTOSTAPHYLOS RAINBOWENSIS
76.8 - ERICACEAE
NORTH OF FALLBROOK
SAN DIEGO COUNTY

Phytophthora ramorum

Mt Tamalpais, Marin Co.

Credit: Latham, CDFA



Arctostaphylos glandulosa and *Arctostaphylos virgata*

2015

Eastwood's manzanita & Marin manzanita (rare plant)

Pathways for *Phytophthora* movement.

1. From Santa Cruz nursery. 2. Big Sur hotel 3. LPNF



Finding *Phytophthora ramorum* in the natural environment of north Vietnam

UK Forest Research



Origin of the sudden oak death pathogen



Pria Graves Illustrations

Tuesday Jun 06 2017 | 0 comments

New Invasive Plant Disease in Placer County

By: Trish Grenfell



2014



Photo by Ted Swiecki, Phytosphere Research

Phytophthora: New Strains Breaking the Mold

New Strains Breaking the Mold

by *Alison Hawkes*

June 28, 2016

LOCAL // BAY AREA & STATE

Parks officials in Bay Area work to keep out plant-killing molds

Photo by David Periman | Feb. 6, 2015 | Updated: Feb. 7, 2015 10:59 a.m.



NEWS

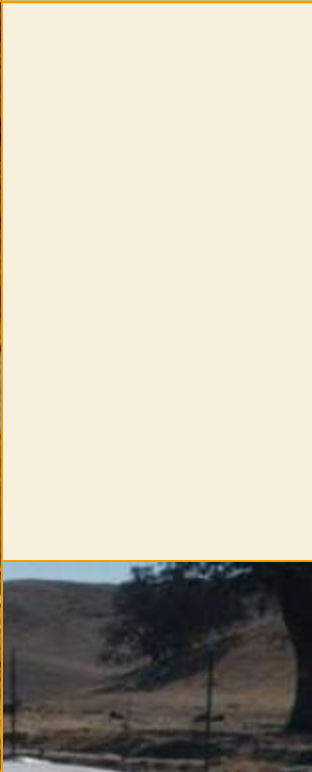


Uploaded: Fri, Sep 23, 2016, 7:48 am

Deadly disease plagues plants high above Silicon Valley

Can local land managers, nurseries stop the spread of fungus-like water mold?

by Sue Dremann / Palo Alto Weekly



Large-scale plantings

Stubborn problems



Phytophthora tentaculata



Santolina



mugwort



Monkeyflower

Rooney-Latham



Monkeyflower

Restoration plantings & hitchhiking *Phytophthoras*



Toyon (*Heteromeles arbutifolia*)



Photos: Phytosphere Research

plant disease

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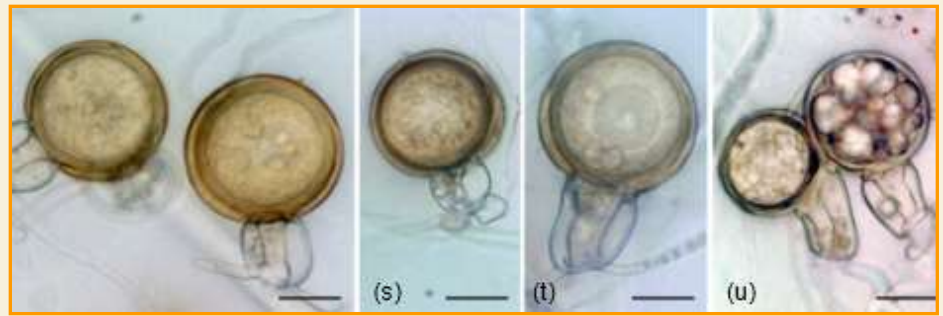
Phytophthora species are common on nursery stock grown for restoration and revegetation purposes in California.

Suzanne Rooney-Latham

Cheryl L. Blomquist

Kathleen L Kosta

Rooney-Latham, S., Blomquist, C.L., Kosta, K.L., and others. 2018. *Phytophthora* species are common on nursery stock grown for restoration and revegetation purposes in California. *Plant Disease*. Early view



Phytophthora parvispora

First detection in North America - *Phytophthora parvispora*

Mexican orange blossom (*Choisya ternata*)

- non-native, ornamental

Rooney-Latham, S., Blomquist, C.L., Kosta, K.L., and others. 2018. *Phytophthora* species are common on nursery stock grown for restoration and revegetation purposes in California. *Plant Disease*. Early view

***Phytophthora* Species in Restoration Plantings and Nursery Stock on the Angeles NF**



**Katie VinZant, U.S. Forest Service, ANF
Susan Frankel, U.S. Forest Service, PSW
Ted Swiecki, Phytosphere Research**

Are Phytophthoras surviving in restoration sites on the ANF?

- Tested 71 samples at 15 sites, scattered over various veg types
- Sites planted 6 months to 6 years previously
- Live and dead containers
- Sampled 14 different plant species



Nursery #1 = 3 species

Nursery #2 = 3 species

Nursery #3 = 5 species

Nursery #4 = 1 species



**Infested *Artemisia californica*
(California sagebrush)**

Phytophthoras detected	Nsy ID #	Host species
<i>Phytophthora cactorum</i>	1	<i>Cercocarpus betuloides</i> , <i>Heteromeles arbutifolia</i> , <i>Salvia mellifera</i>
<i>Phytophthora cactorum</i>	2	<i>Quercus agrifolia</i>
<i>Phytophthora cambivora</i>	3	<i>Quercus chrysolepis</i>
<i>Phytophthora citrophthora/colocasiae</i>	3	<i>Adenostoma fasciculatum</i>
<i>Phytophthora cryptogea complex</i>	2	<i>Eriogonum fasciculatum</i> , <i>Salvia mellifera</i>
<i>Phytophthora hedraiaandra</i>	3	<i>Cercocarpus betuloides</i>
<i>Phytophthora nicotianae</i>	4	<i>Acmispon glaber</i> , <i>Arctostaphylos glandulosa gabrielensis</i> , <i>Artemisia californica</i> , <i>Eriodictyon crassifolia</i> , <i>Eriogonum elongatum</i> , <i>Quercus agrifolia</i> , <i>Salvia mellifera</i>
<i>Phytophthora nicotianae</i>	1	<i>Baccharis salicifolia</i> , <i>Populus fremontii</i> , <i>Salix lasiolepis</i>
<i>Phytophthora nicotianae</i>	3	<i>Quercus john-tuckeri</i> , <i>Q. wislezenii</i> , <i>Rhamnus illicifolia</i>
<i>Phytophthora nicotianae</i>	2	<i>Salvia mellifera</i>
<i>Phytophthora niederhauserii</i>	1	<i>Eriogonum fasciculatum</i> , <i>Heteromeles arbutifolia</i> , <i>Salvia mellifera</i>
<i>Phytophthora pini</i>	3	<i>Cercocarpus betuloides</i>

Italy, Sardinia



“The widespread planting of exotic plant species ...for coastal dune protection and restoration over decades suggest infested nursery stock as the primary pathway of *Phytophthora* spp. to the National Park of La Maddalena.”

Diversity of *Phytophthora* Species from Declining Mediterranean Maquis Vegetation, including Two New Species, *Phytophthora crassamura* and *P. ornamentata* sp. nov.





Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Help!!!

Response to *Phytophthora* detections in restoration sites



Solarization, augers, ovens



Photos: Janell Hillman, SCVWD

Response to *Phytophthora* detections in restoration sites



Solar soil ovens, June 2018, above San Jose



Response to *Phytophthora* detections in restoration sites

San Francisco Water Department (SFPUC)



SFPUC - SUNOL NURSERY
Sunol, CA (Started 2017 and scheduled to be completed 2018)

Working to Save Our Oaks

Behind this fence is one of many SFPUC projects designed to protect and enhance the natural resources of the Peninsula Watersheds. The trees surrounding this creek are in danger from sudden oak death (SOD), an introduced disease that kills several species of native California oaks. In 2009, the SFPUC began a study to protect these trees from SOD by removing nearby California bay trees, which harbor and transmit the disease to the oaks.



1. Sudden oak death is caused by a soil pathogen that multiplies in the soil, and is transmitted to oak trees through root-to-root contact, or through wounds on the trunk or branches.

2. Sudden oak death is a deadly disease that kills several species of native California oaks. In 2009, the SFPUC began a study to protect these trees from SOD by removing nearby California bay trees, which harbor and transmit the disease to the oaks.



We can limit the spread of SOD by keeping California bay from growing among oaks. By removing bay trees from this area, we balance *P. ramorum* spores from these oaks for oaks, protecting them from SOD and maintaining the important ecological values they provide.

For more information on SOD please visit www.suddenoakdeath.org.



Regional Water System
San Francisco Public Utilities Commission



San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Fighting back - Presidio Trust, Golden Gate NRA

Phytophthora BMPs for Natural Resource Field Staff Daily Refresher Checklist and Training Log



Phytophthora training and education: for all field staff, new hires, interns, contractors, etc.

Initials

Everyday Checklist

Phytophthora is Greek for "plant destroyer". It is a genus of "water molds" that are capable of causing massive die-off to plants.

Large scale Phytophthora infestations can wipe out natural plant communities which could cause erosion, habitat degradation, and have major economic impacts for our Park

Like other molds, Phytophthora spreads through spores that can live for long periods of time, even in dry soil.

Remove ground plant parts.

Following Phytophthora BMPs

Sanitizing agents; allow workers the time to

Wet conditions are prime conditions for Phytophthora

Wash clothes, shoes, tools, vehicles, etc. We may



2016

Presidio Phytophthora Management Recommendations



CNPS – Native Here Nursery, Tilden Park (Contra Costa Co.)

California Native Plant Society



CALIFORNIA NATIVE PLANT SOCIETY • VOL 46 / NO 2

CNPS Policy Supports Clean Nursery Practices

Our California landscapes are facing threats from new diseases that we are not prepared to control once they are introduced. The greatest threat is from a disease-causing agent

WHAT IS PHYTOPHTHORA?

Phytophthora is a genus of microscopic water molds, fungal-like organisms. Most—if not all—of the over 120 described species cause plant diseases,



epiphore Research

CNPS- Milo Baker Chapter Nsy, Sonoma Co.

Pointing out the need for change – is difficult.

- Consider disease prevention in restoration design.**
- Use stock grown in nurseries with strict Best Management Practices for sanitation.**

www.calphytos.org

Prevention! Don't let nursery plants sit in water!



**HOW TO
REBUILD
A FOREST**

NOT!

realizing that for restoration efforts to succeed, they need to think more broadly — about matching trees to their location, about the effects on nearby insects and other animals, and about relationships with soil and



Phytophthoras in Native Habitats Work Group

Other Phytophthora species in California's Native Habitats

Several first-in-the-USA detections and newly identified species of *Phytophthora* in both native plant nurseries and restoration areas have occurred in recent years. Many of these *Phytophthora* species appear to have wide host ranges, capable of causing disease on plants across many families and in many different habitats. The **Phytophthoras in Native Habitats Work Group** formed to determine steps needed to protect wildlands and assist the restoration industry. The Work Group is now part of the California Oak Mortality Task Force and serves as an "Other Phytophthoras" committee for that group.

More information can be found in the following:

- [Background document](#) (February 2017)
- [Frequently Asked Questions](#) (February 2017)
- [Briefing paper](#) (May 2015)

For more information on *Phytophthora* species around the world,



Photo by Janell Hillman, Santa Clara Valley Water District

www.calphytos.org or
www.suddenoakdeath.org

California Oak Mortality Task Force



[Home](#) [What is Sudden Oak Death?](#) [Diagnosis and Management](#) [Maps & Visual Media](#) [Newslett](#)



www.suddenoakdeath.org

Sudden Oak Death is a tree disease caused by the pathogen *Cryphonectria parasitica*. First recognized in the mid 1990s, the disease kills some oak species (primarily coast live oak, *Quercus agrifolia*, and an oak relative, tanoak, *Notholithocarpus densiflorus*) and has had devastating effects on coastal forests in California and Oregon. The pathogen also infects rhododendrons, camellias, and other

Mark your calendar...

7th Sudden Oak Death Science & Management Symposium June 25 - 27, 2019. Golden Gate Club, The Presidio.





Acknowledgements

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David Rizzo and Tyler Bourret, UC-Davis;
Katie VinZant and Janet Nickerman, Angeles National Forest
and many others.**

For info on sudden oak death: www.suddenoakdeath.org.

For Phytophthoras on native plants: www.calphytos.org.

