

Sudden Oak Death and Other *Phytophthora* Problems in California 1995 to 2025 – Thirty Years



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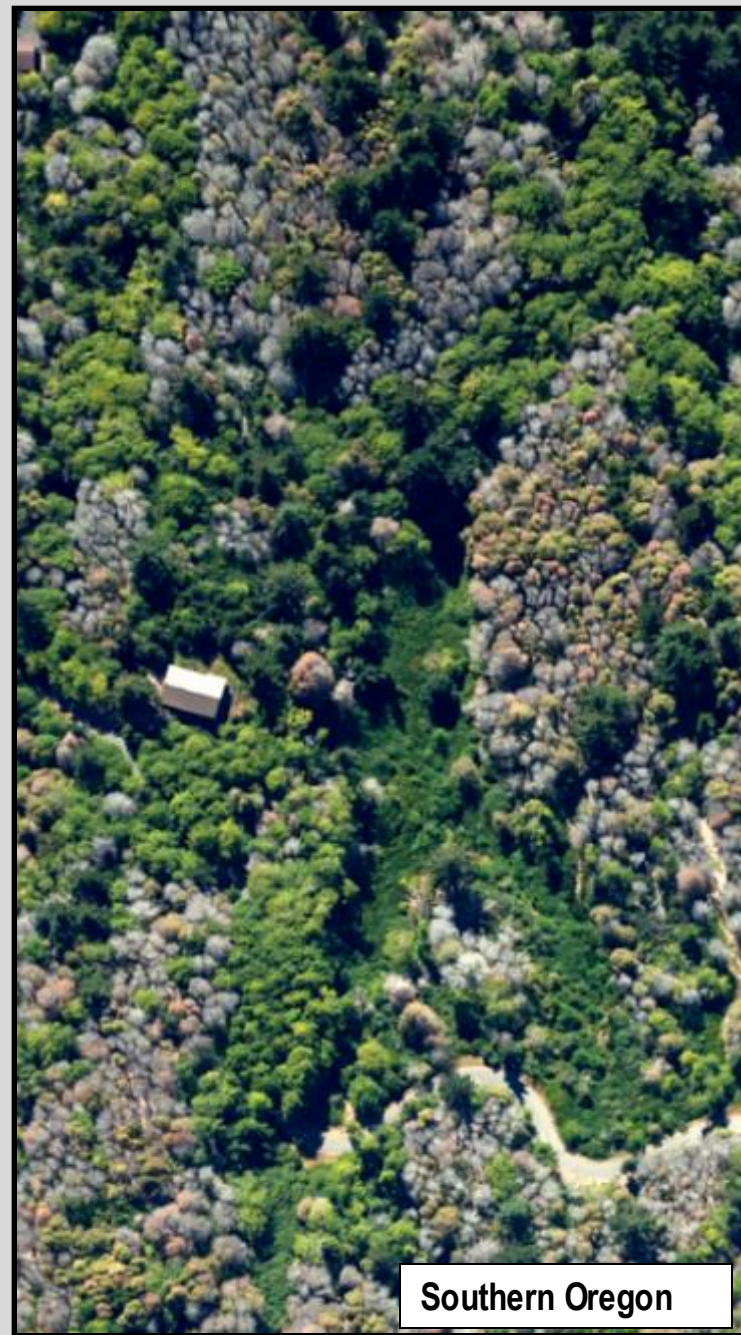
Phytophthoras in California

- 1) Sudden oak death, *Phytophthora ramorum*, 1995 to 2025
- 2) *Phytophthora* introductions in restoration sites, 2014 – 2025
- 3) *Phytophthora* concerns on forest trees

Key points

- It takes all of society to respond to *Phytophthora* outbreaks
- Communication is key
- Management depends on increasing social capacity: progress is incremental but continual improvement is possible!

Sudden oak death, *Phytophthora ramorum*



Photos: Marin Municipal Water District, ODF



Coast live oak, *Quercus agrifolia*

Photo: Stephen Joseph

Initial response. 1995 to 2004. New disease

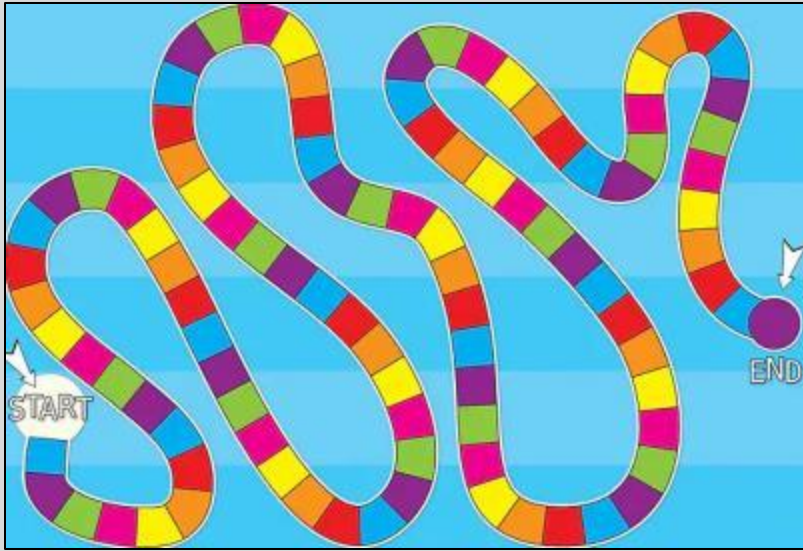
Panic.

Fear.

Outrage.

Despair.

Denial.



Calm.

Concern.

Responsibility.

Cooperation.

Courage.

Safety.

2004 – 2010. Can we ship strawberries? Grapes?



130+ hosts and soil

Need to know...

- Christmas tree and firewood cutters,
- spice and floral companies,
- bulb growers,
- tribes,
- nursery growers,
- compost facilities,
- municipal waste collection services,
- homeowners, residents,
- utility companies,
- arborists,
- landscapers,
- environmentalists,
- pallet and flooring manufacturers,
- foresters,
- parks and open space managers,
- regulators,
- politicians,
- campers, mountain bikers, hikers,
- firefighters,
- Christmas tree growers,
- urban foresters and others.

To protect trees & plants - need to understand problem and target risk.

Legislation, funding & quarantines

- 2000 - California - 4 sudden oak death bills: SB31 Chesbro, AB53 Wiggins, AB62 Migden, & ACR Nation.**
- 2002 - CA bill. AB2251 J. Nation & Migden, SOD management.**
- 2002 - US quarantine and quarantines enacted by CA and Oregon. Australia, UK, South Korea, European Union & others.**
- 2004 - 60+ countries restrict plant shipments.**
- 2004 - 15 more US states issue quarantines. Nursery industry lawsuits follow to protest.**
- 2004 - S.2575 Boxer (D-CA) & Smith (R-OR) Federal legislation.**
- 2005 - Federal budget earmarks for SOD over \$10 million + H.R. 4569 Burns (Georgia).**
- 2017 - Oregon Sudden Oak Death Task Force convened by Oregon State Representative David Brock Smith and US Senator Merkley.**

Interventions can be dramatic & costly



+ \$35 million in Oregon.
State mandated eradication.

LeBoldus, J.M., Navarro, S.M., Kline, N., Ritokova, G. & Grünwald, N.J. 2022. Repeated emergence of sudden oak death in Oregon: chronology, impact, and management. *Plant Disease*, 106(12): 3013-3021.

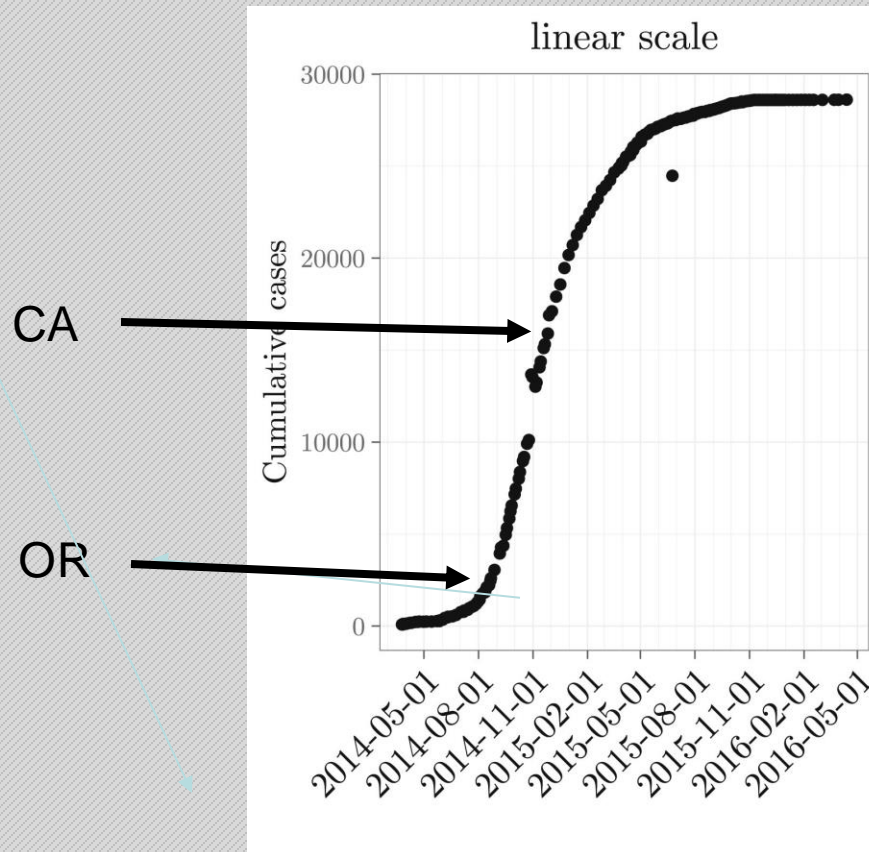
2010: A Decadal Look Back

Environmental Management (2010) 46:315–328
DOI 10.1007/s00267-010-9512-4

FORUM

Lessons Learned from a Decade of Sudden Oak Death in California: Evaluating Local Management

Janice Alexander · Christopher A. Lee



California and Oregon began awareness of *Phytophthora ramorum* at two different points on the epidemic curve

Photo: Ma, A, 2020,
Infectious Disease Modeling,
5: 129-141

A Decade of SOD in California: Three Lessons

Connections count

Scale matters

Building capacity is crucial



Media



“UC Eggheads Find Where Oak Plague Started” – East Bay Express, 4/08

“GODZILLA FUNGUS!!” – Marin Independent Journal, 2000

SPORTS
Detroit-Lakes Tribune 8/2019
Sudden oak death disease on its way, Minnesota officials warn

California Sudden Oak Death Reaches Catastrophic Levels
10/2016 CBS NEWS

FOX 59 NEWS VIDEOS MORNING TRAFFIC COMMUNITY CONTESTS PODCASTS ON-AIR TEAM SPORTS WEATHER 66°
DNR finds oak tree killing fungal pathogen in rhododendrons
POSTED 7:34 PM, MAY 22, 2019, BY JOE HOPKINS

☰ eEdition ☀ 73°
The Press Democrat
Sudden oak death rebounds in Sonoma County, spreads in California

☰ **St.LouisPublicRadio**

Sudden Oak Death Pathogen Found In Illinois And Missouri

Phytophthora in Restoration Areas – 2014 to 2024



Toyon (*Heteromeles arbutifolia*)




Diplacus aurantiacus (formerly *Mimulus*)




San Francisco Bay National Wildlife Refuge Complex



San Pablo Bay National Wildlife Refuge is managed as part of the San Francisco Bay National Wildlife Refuge Complex.




U.S. Fish & Wildlife Service




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RESEARCH

***Phytophthora* Species Are Common on Nursery Stock Grown for Restoration and Revegetation Purposes in California**

S. Rooney-Latham , C. L. Blomquist, K. L. Kosta, Y. Y. Gou, and P. W. Woods

Affiliations [▼](#)

Published Online: 10 Jan 2019 | <https://doi.org/10.1094/PD>



Credit: CALSCAPE

***Phytophthora* species were detected from 77% of the native plant nurseries. (N = 26)**

15 *Phytophthora* species



Credit: CDFA

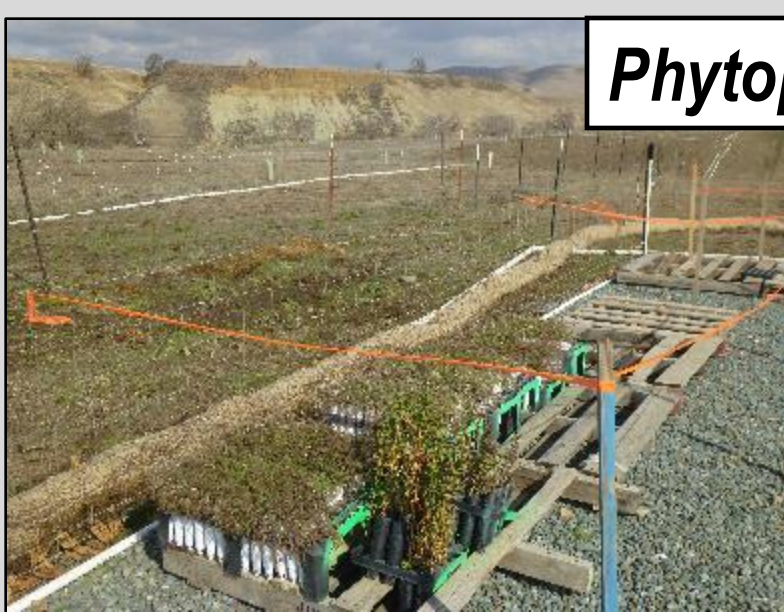
Rooney-Latham, S., Blomquist, C.L., Kosta, K.L., Gou, Y.Y., & Woods, P.W. 2019. *Phytophthora* species are common on nursery stock grown for restoration and revegetation purposes in California. Plant Disease, 103(3): 448-455.

Mugwort



Calscape

Phytophthora tentaculata



Monkeyflower



Calscape

Mugwort



CDFA



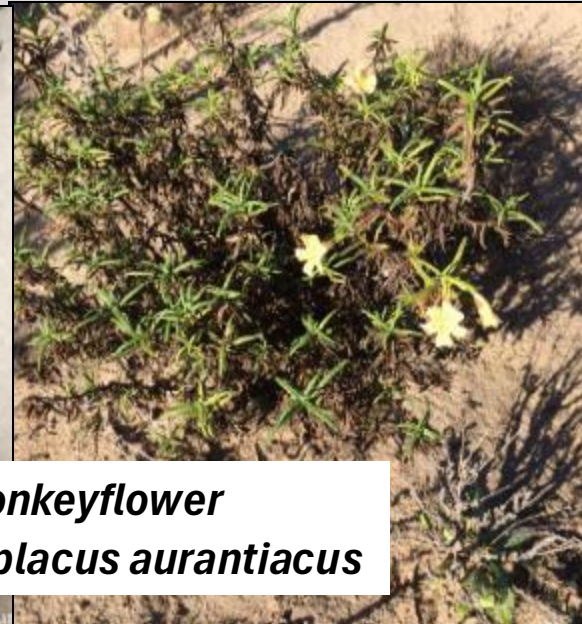
Phytosphere Research

**Mugwort,
*Artemisia
douglasiana***



Photo: S. Rooney-Latham

**Monkeyflower
*Diplacus aurantiacus***



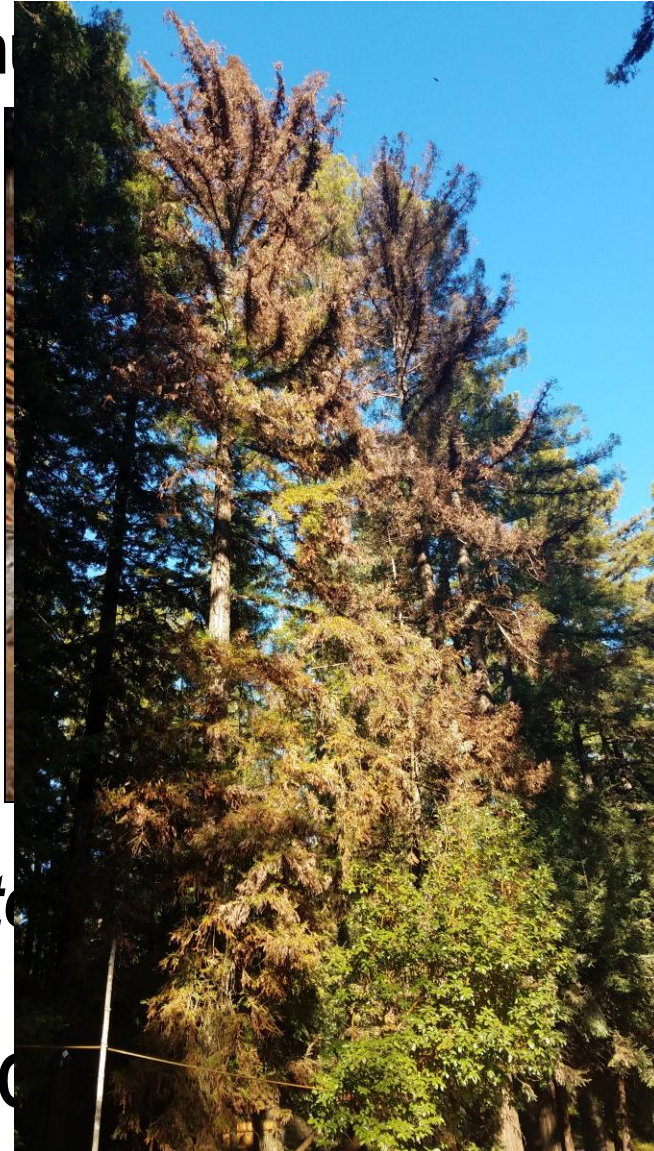
California native plant nurseries & restoration areas

- *Phytophthora* highways



Photos: J. Hillman - Valley Water, CDFA, SFPUC, Phytosphere Research

Endangered species – *Ceanothus ferrisiae*, - Coyote ceanoth



Phytophthora cacti

Endemic to Santa C
6000 individuals remaining in 5 occurrences.

lone manzanita, *Arctostaphylos myrtifolia*

Apricum Hill Reserve, Amador County



Sierra
Nevada
Foothills

Endangered

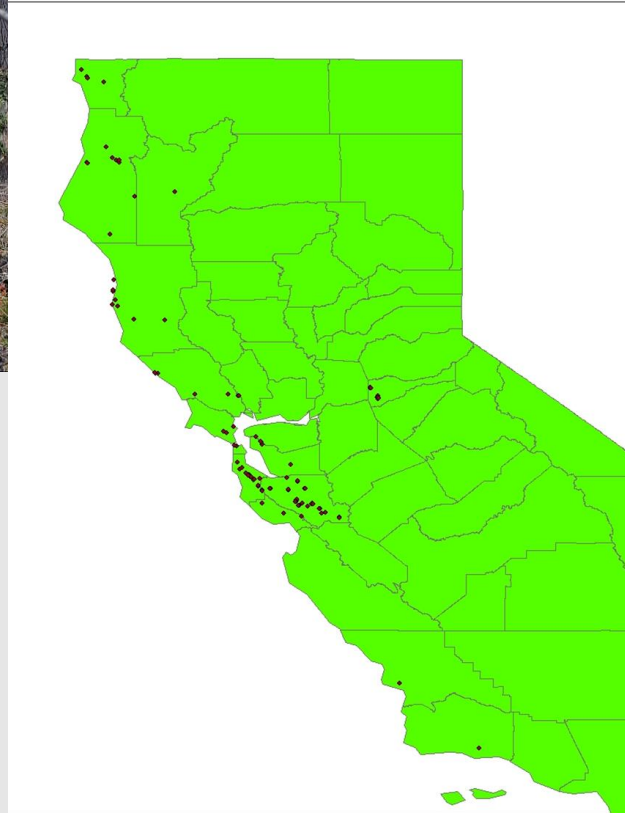


Phytophthora cinnamomi

Photos: J. Hillman, Calscape



Phytophthora damage in California wildlands



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RESEARCH

Cataloging *Phytophthora* Species of Agriculture, Forests, Horticulture, and Restoration Outplantings in California, U.S.A.: A Sequence-Based Meta-Analysis

Tyler B. Bourret  Sebastian N. Fajardo, Susan J. Frankel, and David M. Rizzo

Affiliations ▾

Published Online: 9 Jan 2023 | <https://doi.org/10.1094/PDIS-01-22-0187-RE>Vol. 107, No. 1
January 2023[Next >](#)

Credit: Robert O'Brien

80 *Phytophthora* taxa in California, 61 formally described


Isolate origin - grouped by land-use:

- (1) agriculture,
- (2) forests & natural ecosystems,
- (3) nurseries & horticulture,
- (4) restoration outplantings.

Phytophthora communities of “horticulture” & “restoration outplantings” shared the most species.

Bourret, T.B., Fajardo, S.N., Frankel, S. J., & Rizzo, D.M. 2023. Cataloging *Phytophthora* species of agriculture, forests, horticulture, & restoration outplantings in California, USA: a sequence-based meta-analysis. Plant Disease: 107(1): 67-75.

California *Phytophthora* legislation – Introduced, not passed.



California
LEGISLATIVE INFORMATION

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SB-287 Habitat restoration: invasive species: *Phytophthora* pathogens. (2017-2018)

SENATE COMMITTEE ON NATURAL RESOURCES AND WATER

Senator Robert Hertzberg, Chair
2017 - 2018 Regular

Bill No:	SB 287	Hearing Date:	March 28, 2017
Author:	Dodd		
Version:	March 15, 2017		
Urgency:	No	Fiscal:	Yes
Consultant:	William Craven		

Subject: Habitat restoration: invasive species: *Phytophthora* pathogens

BACKGROUND AND EXISTING LAW

- 1) Establishes the California Department of Fish and Wildlife (CDFW) and sets forth its powers and duties to protect wildlife and wildlife habitat in the state. CDFW and other state agencies such as the regional water boards, local governments and others, frequently require mitigation for projects that have environmental impacts and the mitigation in many circumstances occurs on wildlife or habitat lands.
- 2) *Phytophthora* are microscopic plant pathogens that can severely damage or kill a



SB 287 – DODD

Phytophthora Pathogens – Habitat Restoration

Summary

SB 287 would require the Department of Fish and Wildlife to ensure that habitat restoration projects authorized, mandated, or funded by the State use clean nursery stock to minimize the introduction and spread of damaging *Phytophthora* plant pathogens into wildlands.

State agencies promote the use of nursery stock in wildlands through their vegetative cover standards for habitat restoration projects. The best defense against *Phytophthora* pathogens becoming established in wildlands, parks, open space and wetlands is to prevent their inadvertent introduction via infested nursery stock.

Background

Phytophthora (pronounced Fie-TOF-ther-uh; "plant destroyer" in Greek) is a group of microscopic plant pathogens that can damage

Existing Law

Existing law does not directly address the use of planting material infected with *Phytophthora* or other pathogens in restoration plantings.

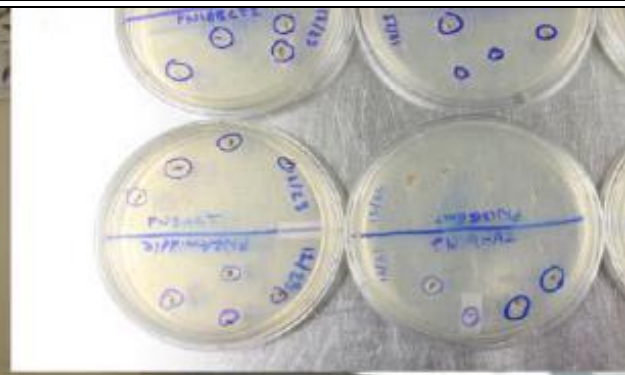
Fighting back - Presidio Trust, Golden Gate NRA

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.	
Phytophthora spores exist in the root material of plants, but can also be in above ground plant parts.	





CALIFORNIA OAK MORTALITY TASK FORCE

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)



www.calphytos.org or
www.suddenoakdeath.org



Accreditation to Improve Restoration (AIR)

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Accreditation to Improve Restoration (AIR)

Protecting Native Habitats by Excluding *Phytophthora* in the Nursery

About the Program

Strict *Phytophthora* Nursery Best Management Practices

See: airnursery.ucdavis.edu

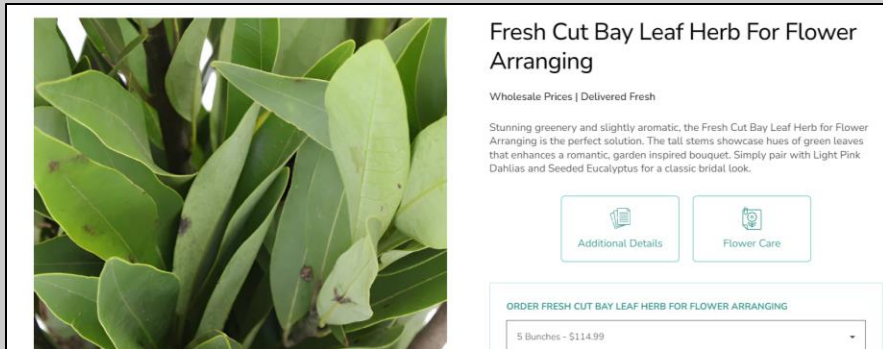
Swiecki, Tedmund J., Elizabeth A. Bernhardt, and Sean G. McClanahan. Validating and Optimizing a Method for Detecting *Phytophthora* Species by Baiting Leachate from Arrays of Container Nursery Plants. *PhytoFrontiers*™ 2024: PHYTOFR-03.



Phytophthora is causing complex, far-reaching problems in California, western North America and beyond.

Addressing these problems requires high-levels of trust between plant pathologists and many types of communities.

Scale of problem and response, communication quality, and response capacity are crucial factors that can determine who gets the upper hand in the battle between damaging non-native *Phytophthora* species and our treasured native landscapes.



Acknowledgements



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