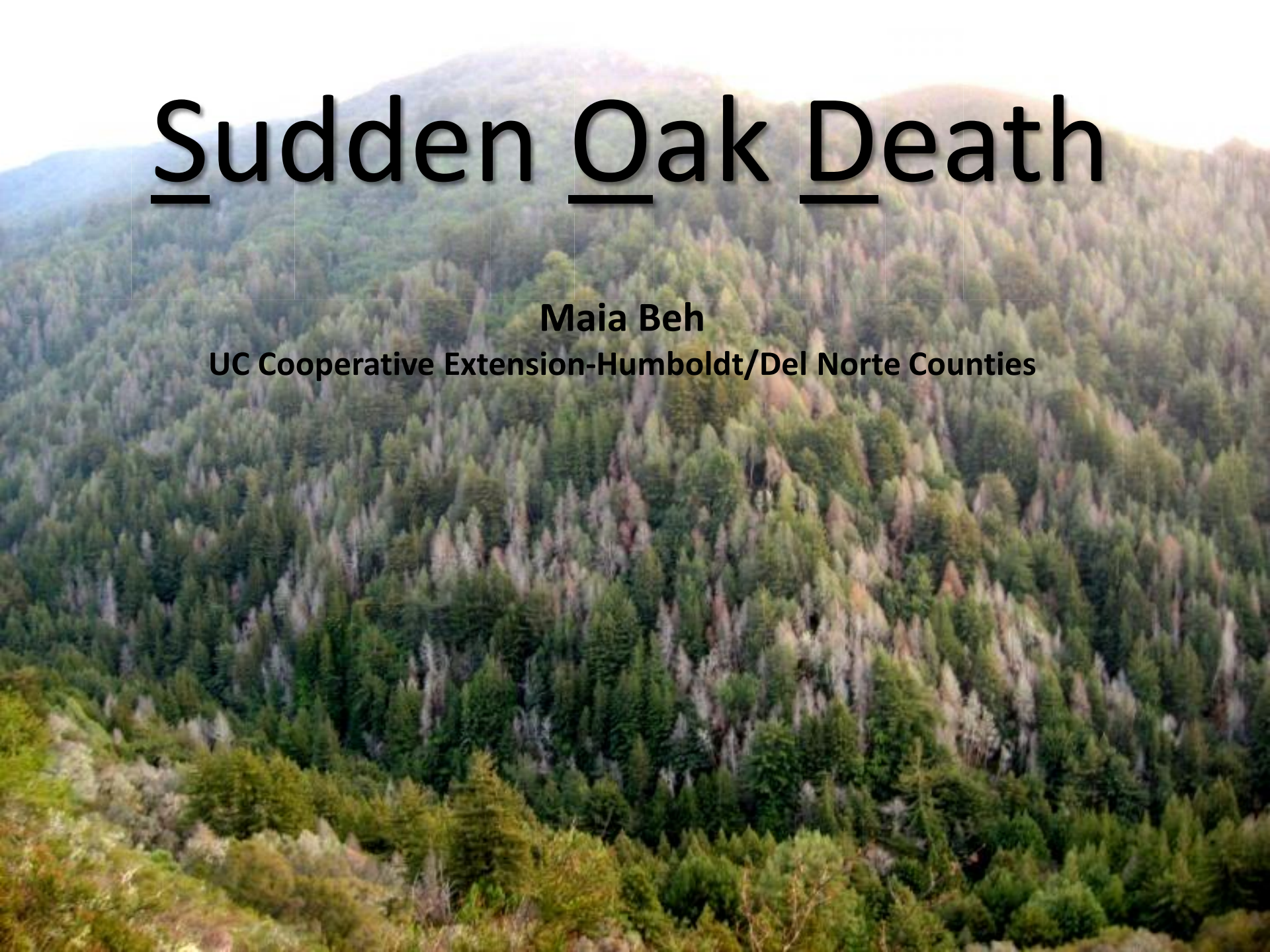
Sudden Oak Death Update for Foresters & Resource Managers

Inglenook

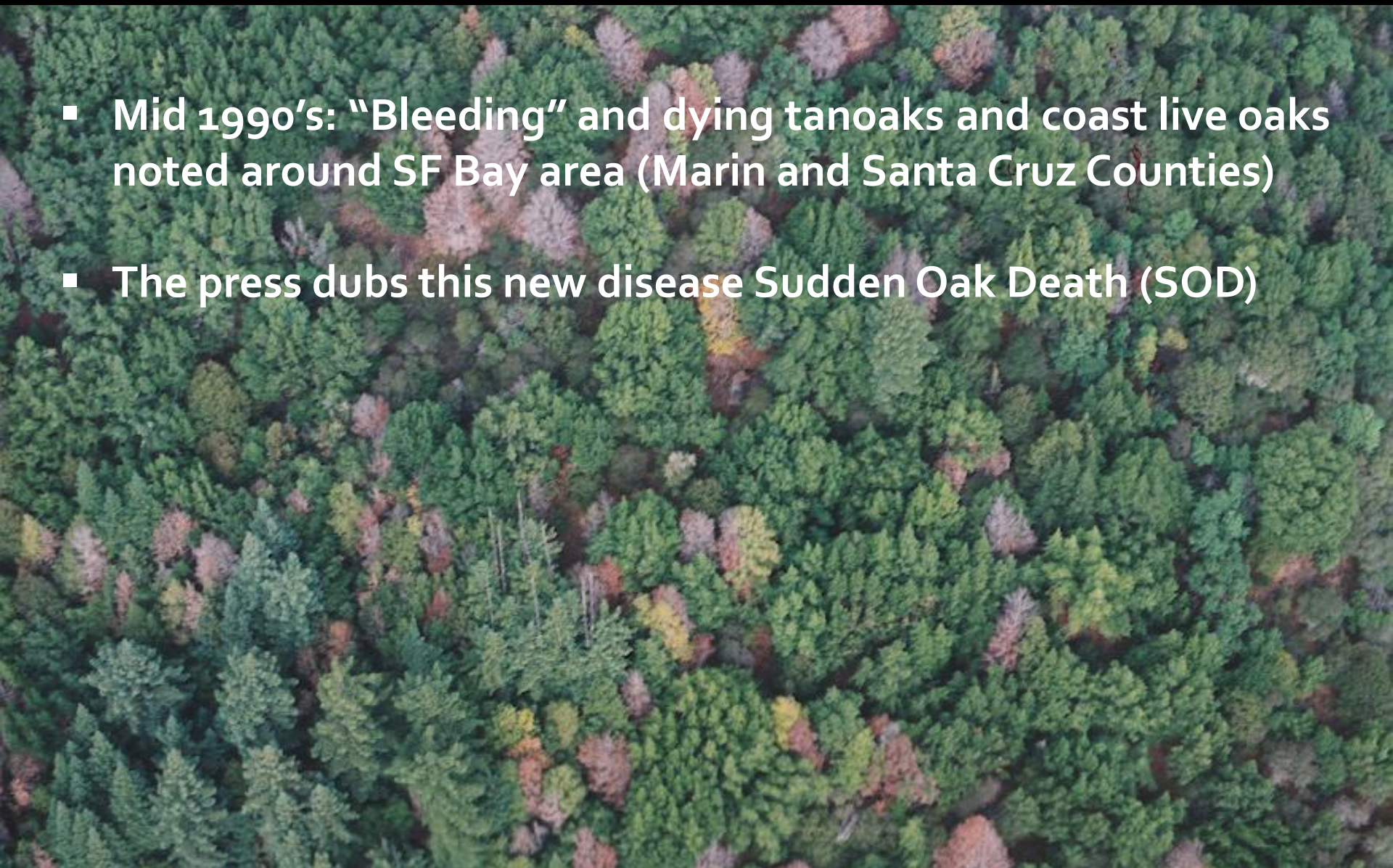
May 8, 2012

Sudden Oak Death



Maia Beh
UC Cooperative Extension-Humboldt/Del Norte Counties

The short story of SOD



- Mid 1990's: "Bleeding" and dying tanoaks and coast live oaks noted around SF Bay area (Marin and Santa Cruz Counties)
- The press dubs this new disease Sudden Oak Death (SOD)

The short story of SOD

- In summer 2000, an unfamiliar species of *Phytophthora* isolated from cankers on tanoaks and oaks.

- In late 2000, it was discovered that the unknown *Phytophthora* spp. was same as new pathogen isolated from Rhododendrons in Europe: *Phytophthora ramorum*.

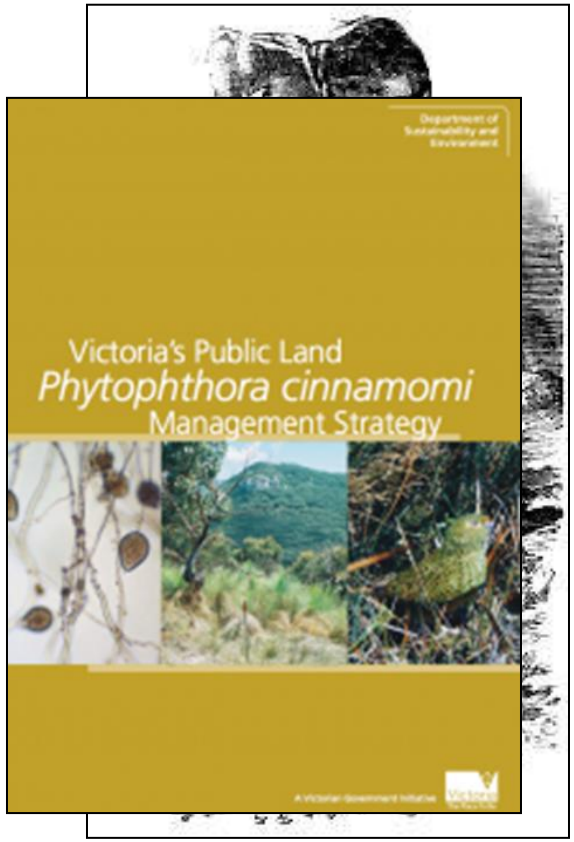
The short story of SOD

- Studies would later reveal that *P. ramorum* was most likely introduced into California's wildlands from outplanted nursery stock.

- The geographic origin of *P. ramorum* is still UNKNOWN

What is *Phytophthora ramorum*?

- All species of *Phytophthora* are pathogens of plants (*Phytophthora* =the Plant Destroyer)
  - *P. infestans*: late blight of potatoes and tomatoes
  - *P. lateralis*: Port Orford Cedar Root Rot
  - *P. cinnamomi*: root rots of numerous tree species
  - *P. pinifolia*: disease of Monterey pines in Chile



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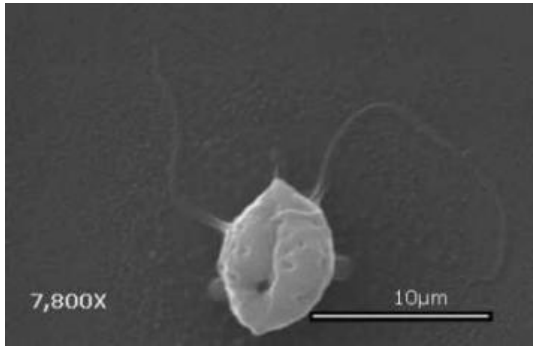
  - *P. pinifolia*: disease of Monterey pines in Chile
- Oomycete:
  - Grow as fungal-like filaments
  - Have many spore types, including motile zoospores
  - Zoospores "swim" in water



Symptoms of *P. ramorum:* One pathogen, two diseases……

Sudden oak death

- **Hosts**: Tanoak, coast live oak, black oak, Shreve oak, canyon live oak
- **Symptoms**: bleeding stem cankers on mature trees; sudden death of canopy with dead leaves retained on tree; stem breakage and failure
- Generally always **fatal** to hosts, but some individuals show resistance

Ramorum leaf blight

- Hosts: Many!!!From ferns to redwoods and nearly everything in between
- Symptoms: necrotic spots on leaves and stem; shoot dieback
- Rarely fatal to hosts

Regulated hosts of *P. ramorum*

- Bay laurel
- Bigleaf maple
- California bay laurel
- California black oak
- California buckeye
- California coffeeberry
- California honeysuckle
- California maidenhair fern
- Camellia - all species, hybrids and cultivars
- Camphor tree
- Canyon live oak
- Cascara
- Coast live oak
- Coast redwood
- Douglas fir
- European ash
- European beech
- European turkey oak
- European yew
- Evergreen huckleberry
- False Solomon's seal
- Goat willow
- Griselinia
- Holm oak
- Horse chestnut
- Lilac
- Madrone
- Manzanita
- Michelia
- Mountain laurel
- Persian ironwood
- Pieris
- Planetree maple
- Red tip photinia
- Rhododendron (including azalea)
- Scotch heather
- Shreve's oak
- Southern red oak
- Sweet chestnut
- Tanoak
- Toyon
- Viburnum
- Western maidenhair fern
- Western starflower
- Witch hazel
- Wood rose

Regulated hosts native to North Coast

- Bay laurel
- Bigleaf maple
- California bay laurel
- California black oak
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Symptoms on California bay laurel

P. ramorum **sporulates on and spreads from bay but does NOT have any effect on health of bay**

Symptoms on coast live oak

P. ramorum **does NOT sporulate on coast live oak: A dead-end host**

Symptoms on tanoak


Lethal trunk canker


Shepard's crook= stem die-back

Dual function host:

i. **Hosts Ramorum leaf blight and spreads the pathogen**
ii. **Dies from sudden oak death**

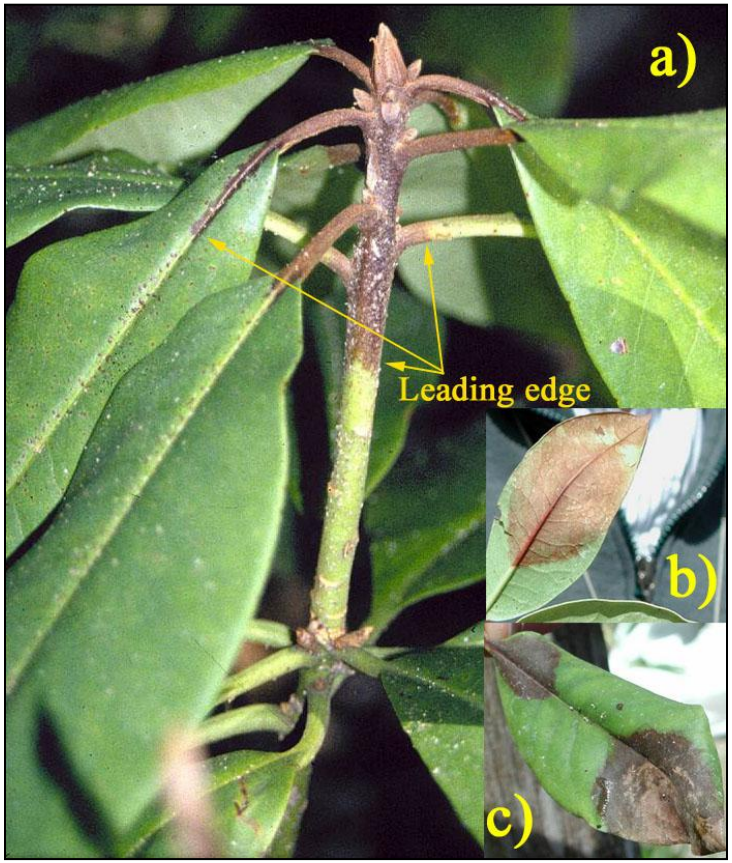
Symptoms on evergreen huckleberry

Symptoms on conifers

Redwood

Douglas-fir

Symptoms on Rhododendrons



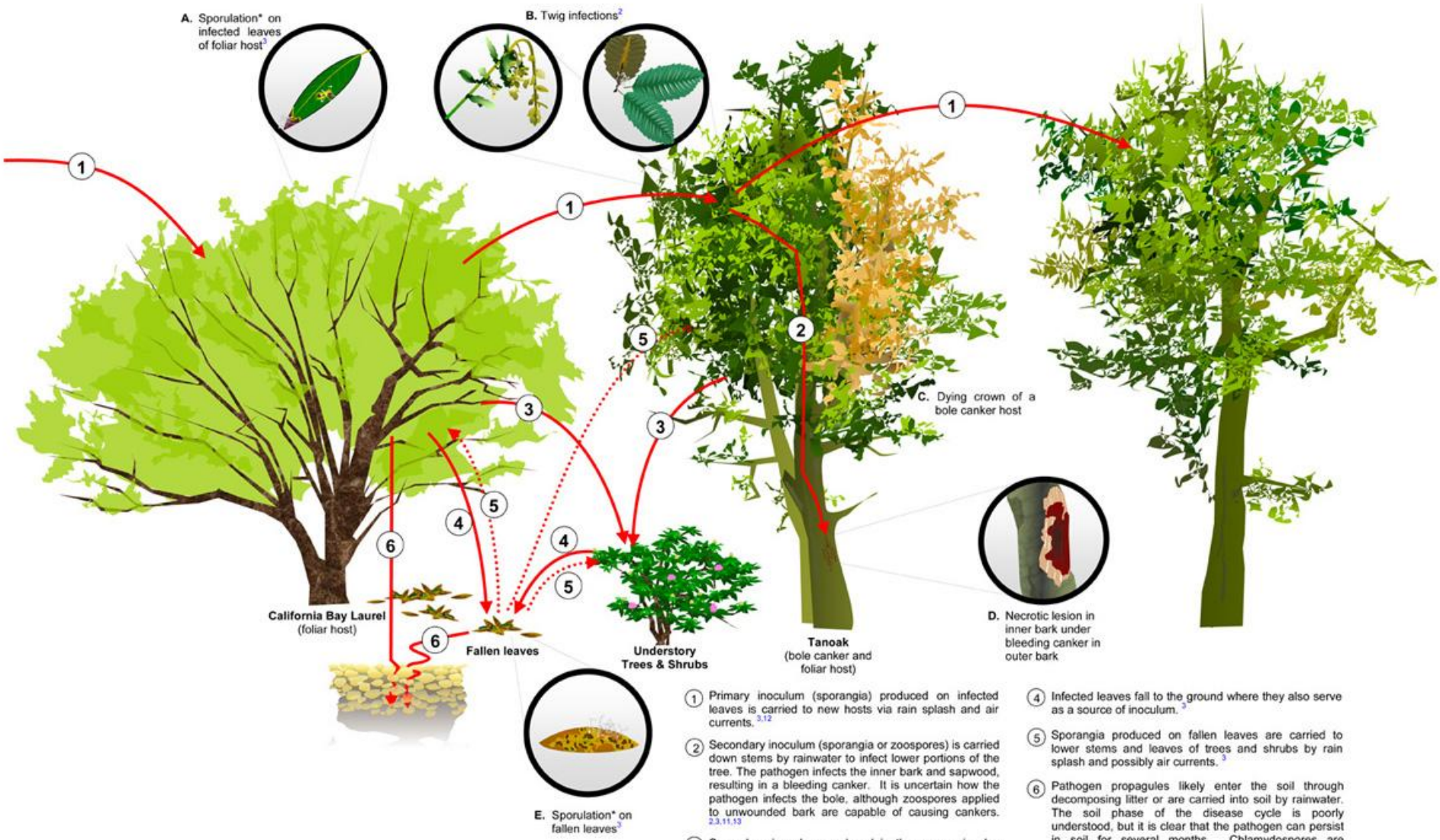
Symptoms on *Camellia*

Symptoms on *Pieris*

How *P. ramorum* reproduces on hosts

The sporangia release zoospores

Proposed Disease Cycle for *Phytophthora ramorum* in Forests*



1. Primary inoculum (sporangia) produced on infected leaves is carried to new hosts via rain splash and air currents.[3,12]
2. Secondary inoculum (sporangia or zoospores) is carried down stems by rainwater to infect lower portions of the tree. The pathogen infects the inner bark and sapwood, resulting in a bleeding canker. It is uncertain how the pathogen infects the bole, although zoospores applied to unwounded bark are capable of causing cankers.[2,3,11,13]
3. Secondary inoculum produced in the canopy is also splashed or blown onto understory tree and shrub hosts causing local intensification of disease.[3,12]
4. Infected leaves fall to the ground where they also serve as a source of inoculum.[3]
5. Sporangia produced on fallen leaves are carried to lower stems and leaves of trees and shrubs by rain splash and possibly air currents.[3]
6. Pathogen propagules likely enter the soil through decomposing litter or are carried into soil by rainwater. The soil phase of the disease cycle is poorly understood, but it is clear that the pathogen can persist in soil for several months. Chlamydospores are presumed to have a role in long-term survival although the triggers for germination are not known. There is little evidence of root infection in the forest.[3,5,8,9,13]

Illustration by N. Ochiai

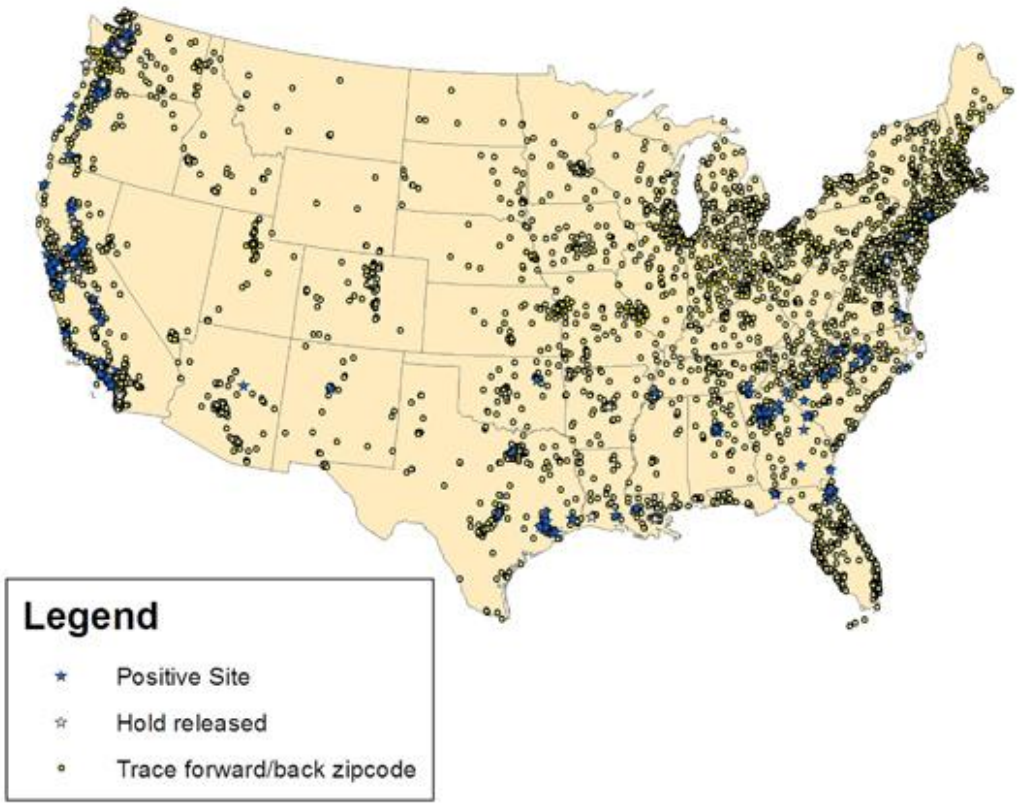
* not drawn to scale

Pathogen dispersal in the forest

- Spores form on bay laurel leaves and tanoak twigs in tree canopies
- Blown by windy rain and air currents
  - Usually 5-10 meters from host
  - Sometimes much further
- These spores infect susceptible hosts that they land on
- Most spores produced in spring time during warm rains

Many modes of pathogen movement

- Naturally in wind and rain
- In soil
- On shoes, tires, and equipment
- In water!
- Via human movement of infected plants



The Latest in the SOD Regulatory World

Mark Stanley
Chair, California Oak Mortality Task Force
Chief Deputy Director CDF (Retired)
RPF 1736

California Oak Mortality Task Force

Regulations 101

State vs. federal regulations

Quarantined counties

Bole hosts vs. foliar hosts

Movement inside the 14 counties

Movement outside the 14 counties

California Oak Mortality Task Force

Quarantined Counties

Humboldt	Contra Costa
Mendocino	Alameda
Sonoma	San Francisco
Marin	San Mateo
Lake	Santa Clara
Napa	Santa Cruz
Solano	Monterey

Federal vs. State

Federal Regulation - USDA Agricultural and Plant Health Inspection Service (APHIS)

California Department of Food and Agriculture (CDFA)

They are "Harmonized"

Both enforced by Ag Commissioner

Regulations Say

Regulated material cannot move outside of the quarantined area without some action.

- This could be an inspection
- Free from protocol
- Mitigation or treatment

Purpose is to not have this disease/pathogen move through human means

California Oak Mortality Task Force






Foliar Symptoms



Inspections

Mainly pertains to nursery products but may include other products:

burls, wreaths, spices, greens, xmas trees

Seeds are not regulated.

"Free From" Protocol

Currently done in and around nurseries in quarantined counties' "Pest Free Zone".

Currently available in forests for movement within the state.

Proposed to APHIS for those counties that are not generally infested. (Still waiting for action from APHIS).

Treatment

Different for different products

- Wreaths - boiling or vacuum treatment
- Tanoak, debarking, kiln drying, fumigation …
- Other bole hosts – debarking

Movement will require some kind of phytosanitary certificate so the receiving party is assured that there is no risk of spread.

Specific Products

Christmas trees - Douglas fir, grand fir, red fir….

Treated as nursery stock and farm is inspected prior to season.

Df boughs for wreaths are regulated as a product and have to be inspected.

The bottom line is that a regulated host has to be treated or mitigated and inspected in order to move out of the 14 counties.

Stay Tun

www.s .org

Force