Phytophthora spp: risks they pose to our restoration goals and how to thwart them

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Cal-IPC Nov. 3rd, 2016

Who am I?

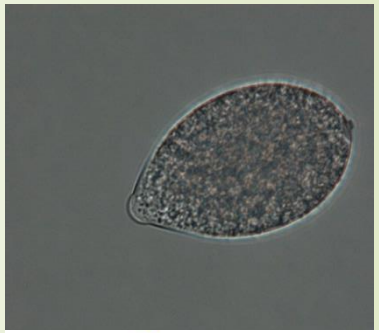
- Not a plant pathologist
- Co-owner of restoration nursery in Richmond, Ca.
- Started our business in 2001 because we saw need for more diverse site-specific plant material for restoration projects
- Business grew from basketball court to football field size, worked with many Bay Area organizations on projects
- Generally having a great time

- But then….

Who are they?

- In December of 2013 I heard from a client that the agency they were working for had received material from a restoration nursery infected with a pathogen
- Phytophthora species, related to the one that caused Sudden Oak Death, only documented once before in California, and on APHIS list of top 5 rated Phytophthora spp to keep out of U.S.
- ***Phytophthora*** (from Greek φυτόν (phytón), "plant" and φθορά (phthorá), "destruction"; "the plant-destroyer") is a genus of plant-damaging Oomycetes (water molds), whose member species are capable of causing enormous economic losses on crops worldwide, as well as environmental damage in natural ecosystems. The genus was first described by Heinrich Anton de Bary in 1875.

Q-Bank photo Phytophtora tentaculata



Why do I care?

- Chestnut blight (actually a fungus), 1st half of 20th century killed 4 billion trees
- Late/Potato blight (P. infestans), in Ireland between 1845-1857 P. infestans related to over one million people starving to death and 2 million others to emigrate
- P. ramorum in California, since 1990's has

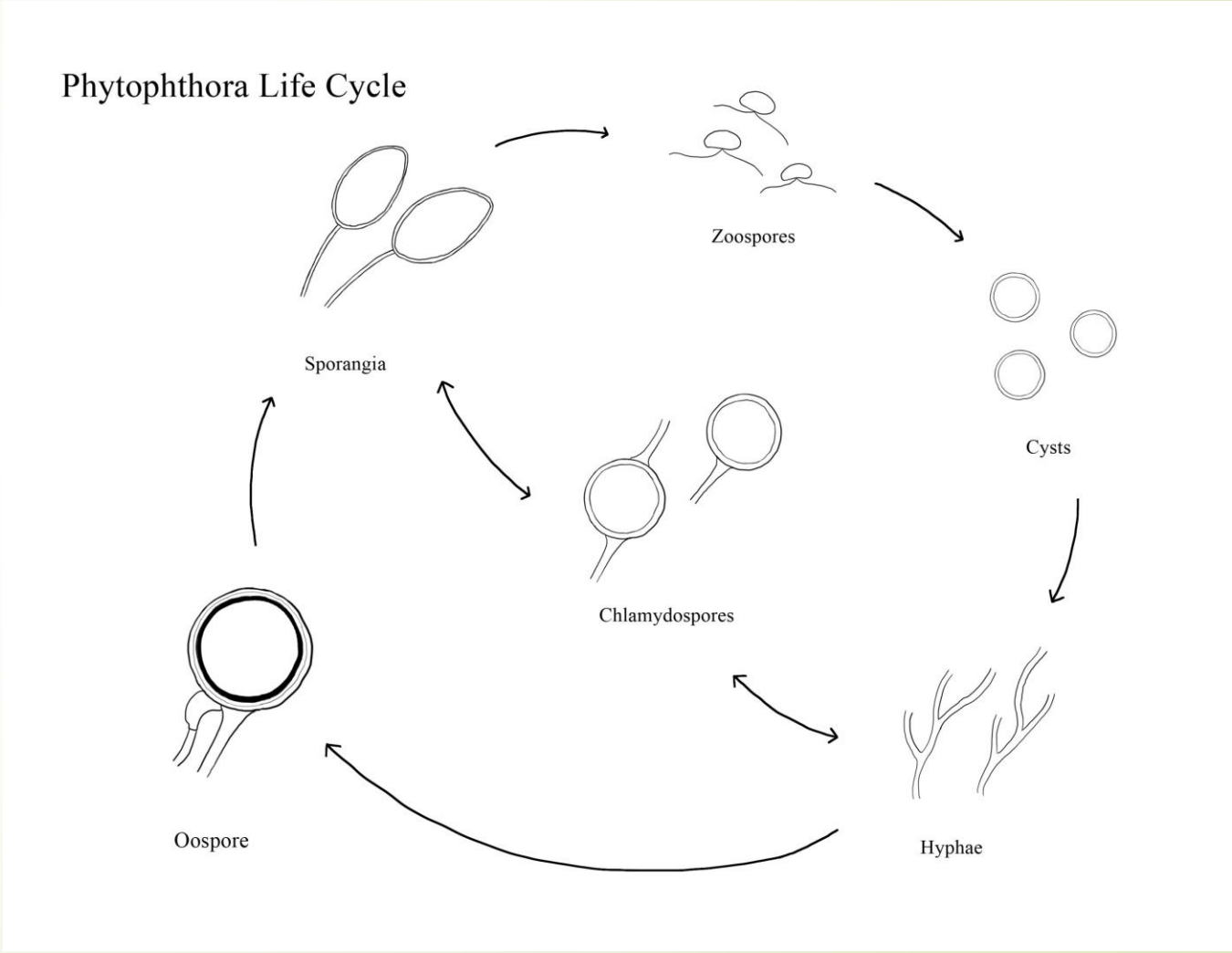
  Has killed millions of tanoak trees and several

  Species of oaks

- Basically doing the business to try to do good
- Met with California Native Nursery Network (CNNN), organized Symposium in Dec. 2014, participant in the organizing member of the Working Group for Phytophthora in Native Habitats, current organizer and participant in the nursery and restoration subcommittees, current organizing member of the CNNN

What do we know? Life Cycle

- Oospores: sexual reproductive spores enable long-term survival in plant tissue or soil
- Chlamydospores: another type of thick-walled, long-term survival spore, but produced asexually
- Both spore types can produce sporangia in presence of water
- Sporangia release short-lived, one-celled, flagellated zoospores that can swim
- When zoospore arrive at suitable infection site they develop a cell wall and become a cyst (a short-lived resting structure)
- Cysts germinate to form microscopic, filamentous hyphae which infect and grow within the plant cells.
- Once plant infected Phytophthora sp. Produces more spores, sporangia and repeats.



Forest Phytophthoras of the World.org

What do we know, cont

- How many are there? ~Over 100 described species. Number increasing as technology to detect improves
  - Some historically described as one species now being identified as several separate species. Puts our understanding of ecology back to close to zero
  - Being found in plant species and habitats previously thought to be not at risk from this type of organism
- How dangerous are they?
  - *P. cactorum* almost causing lone manzanita to go extinct
  - "Phytophthora species are among the most destructive pathogens of agricultural crops and forest in the world" Forest Phytophthoras of the World
- Can we predict impact (ie. Invasiveness)?
  - Method of dispersal- plants, soil, water
  - Habitat of infection
  - Effect of species? Who and when? => Precautionary Principle

Phytosphere Research

So what can we do?

- Some countries ahead of us

Foot bath along popular footpath through Moor House Nation Nature Reserve in North East England

How you can help stop the spread of *Phytophthora*.

The best way to control *Phytophthora* is to prevent the transfer of infested soil or plant material.

- Avoid driving, riding or walking in areas when soils are wet and sticky.
- Stay on designated roads and tracks. Vehicles, bikes and people moving off roads into infested areas may pick up infested soil and transfer it to uninfested areas.
- Brush soil off vehicles, bikes, boots and camping gear before entering an uninfested area and after leaving an infested area. Do not take them home to clean.
- Obey road signs. Roads and tracks may be closed, sometimes permanently, to help stop the spread of *Phytophthora*.
- Use wash down or hygiene stations when provided.
- Protect your bush and your garden. Ensure that purchased plants are free of *Phytophthora*.
- Report any unusual plant death. Please report the death of groups of susceptible native plants to your local Department for Environment and Heritage office.

Please clean your footwear

For further information please contact:

Department for Environment and Heritage
Information Line - Telephone: (08) 8204 1910,
or see SA White Pages for your local

Department for Environment and Heritage office.

Online information available at:

www.environment.sa.gov.au/biodiversity/plantsand.html

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Phytophthora is killing our plants!

Department for Environment and Heritage

Government of South Australia

www.environment.sa.gov.au

- California Oak Mortality Task Force- Sudden Oak Death P. ramorum-research, outreach, education, partial closures, highly regulated in horticultural trade (inspections, quarantines).
- The Working Group for Phytophthoras in Native Habitats group of pathologists, regulators, agencies, nurseries, restoration contractors, environmental consultants working together to develop strategies to address the issue
- Developed website with background, education, resources, updates (Calphytos.org)
- Released Best Management Practices (BMPS) for nursery growers
- Developing BMPS for restoration contractors
- Meeting with regulators to discuss permitting requirements and performance criteria
- Many nurseries, restoration contractors, land managers, agencies have already made huge changes to their infrastructures, practices, policies

How hard is it?

- Initial expense for retrofitting infrastructure, purchasing equipment, associated labor
- Our nursery currently close to additional full time position for heat-treating soil, maintenance of sanitizing chemicals across site, and routine testing
- Most difficult aspect retraining habits
  - Kitchen conduct

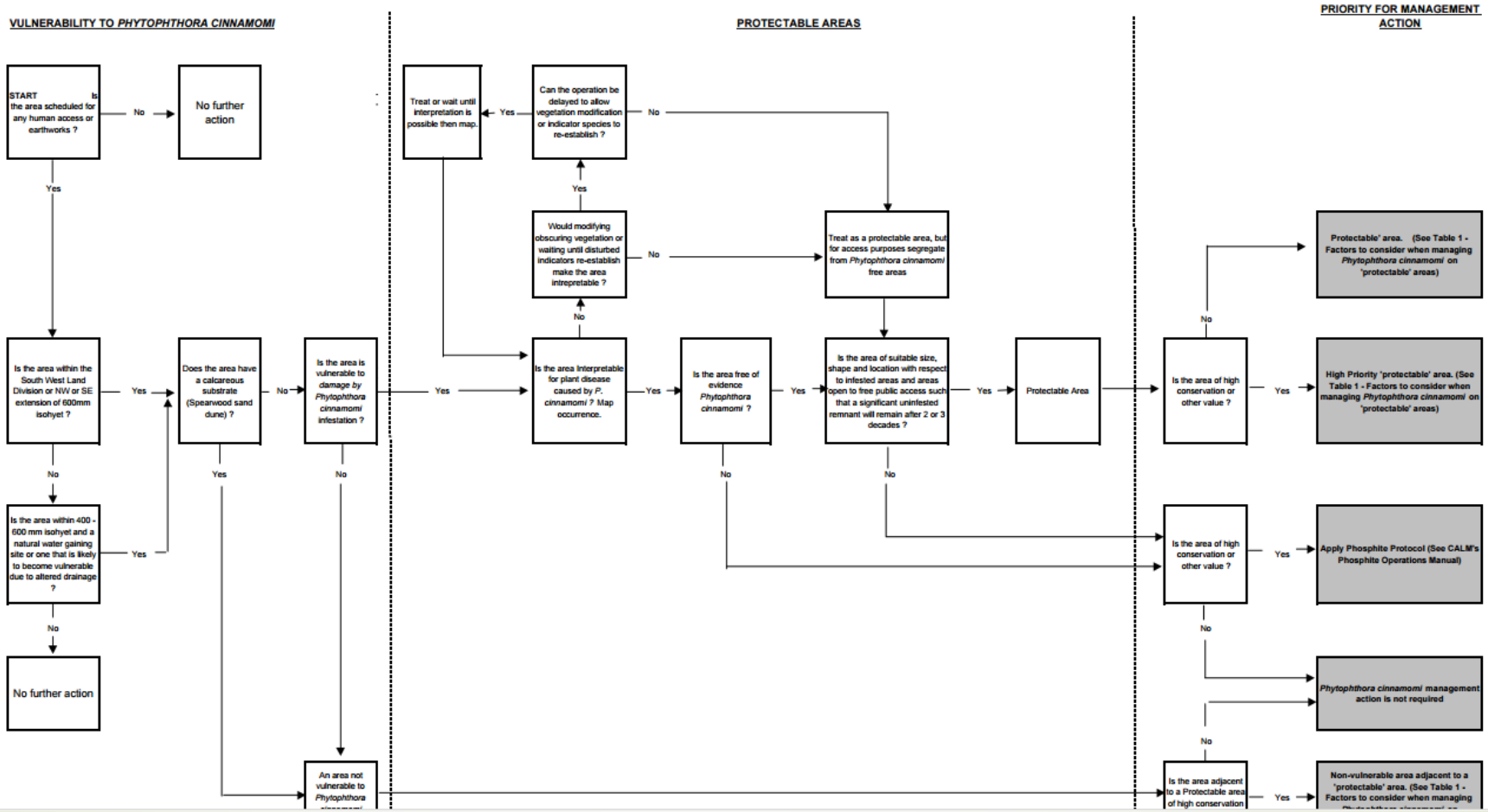
Restoration Contractors:

Agency/regulatory folks
What to require
How meet goals

FIGURE 1. FLOWCHART FOR DETERMINING VULNERABILITY TO DAMAGE BY *PHYTOPHTHORA CINNAMOMI*, DELINEATION OF 'PROTECTABLE AREAS' AND THEIR PRIORITY FOR MANAGEMENT

DRAFT ONLY

[1. An uninfested area, located so as to be amenable to protection from infestation through control on human access and hygienic entry and is of a size and shape that will not be completely overrun in a timeframe of 2-3 decades. May include uninterpretable areas.]
[2. Other areas may retain high conservation, cultural or landscape values that require management action]



So why do it?

- Difficult at first, easier with time
- Real impacts of efforts being documented
- Consequences of not doing it potentially disastrous and completely contrary to all our goals

- Bottom line- Cal-IPC folks some of the best in regards to experience and knowledge to comprehend the risks and challenges of this situation and as individuals and an industry we have, through implementing phytosanitary BMPs, the opportunity to do what we do better than we ever have before.

Thank you! Questions?

Working Group for Phytophthoras in Native Habitats

California Department of Food and Agriculture

UC Davis

California Native Nursery Network

UC Berkeley