Beyond ramorum- the OTHER Phytophthoras in western forests

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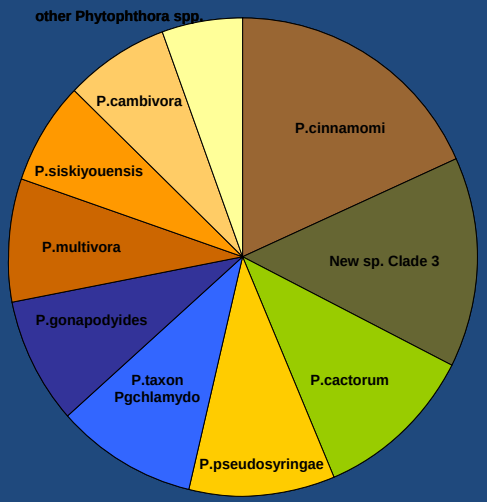
Phytophthora in Forests

- Widespread, Diverse, +/- Numerous
- Soils, Streams, Tree canopies
- Indigenous or Introduced
- Benign or Destructive



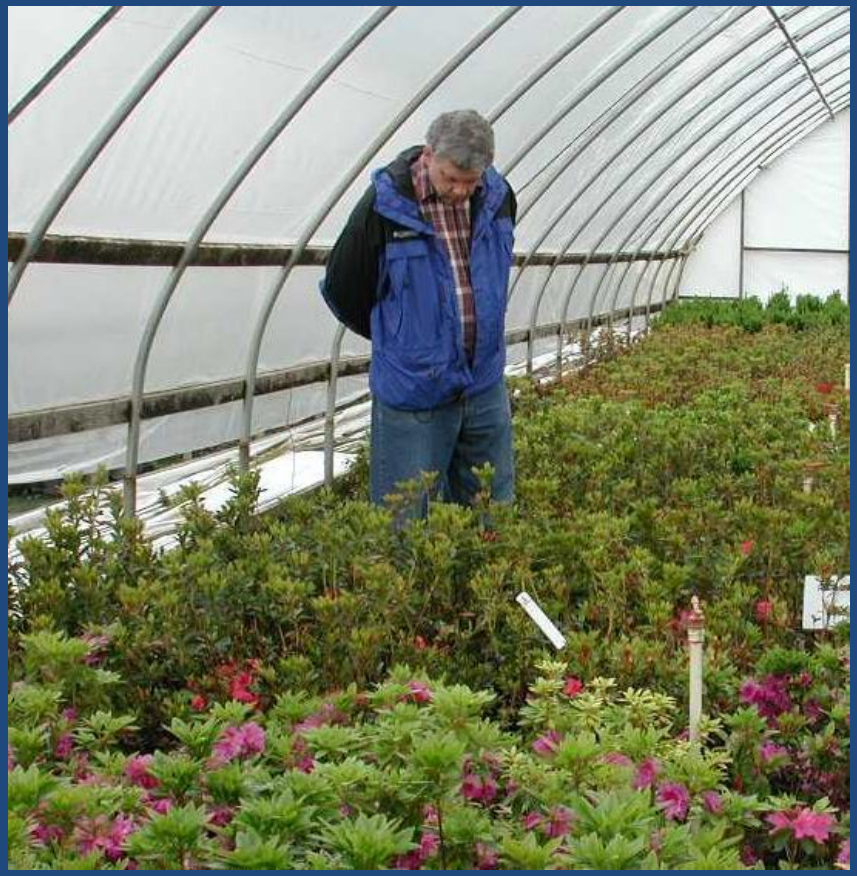
Port-Orford-cedar Root Disease

Phytophthora lateralis

Splash dispersal and stem flow
Landscape-level spread
Airborne
Goheen
Long-distance spread
Nursery Stock
ODA

USDA Confirmed Nursery Protocol

- Susceptible plants held
- Delimitation surveys
- Destroy infected plants
- Monitoring
  - 90-days
- Trace-out investigations
  - Trace forwards
  - Trace backs



ODA

Grower Assisted Inspection Program

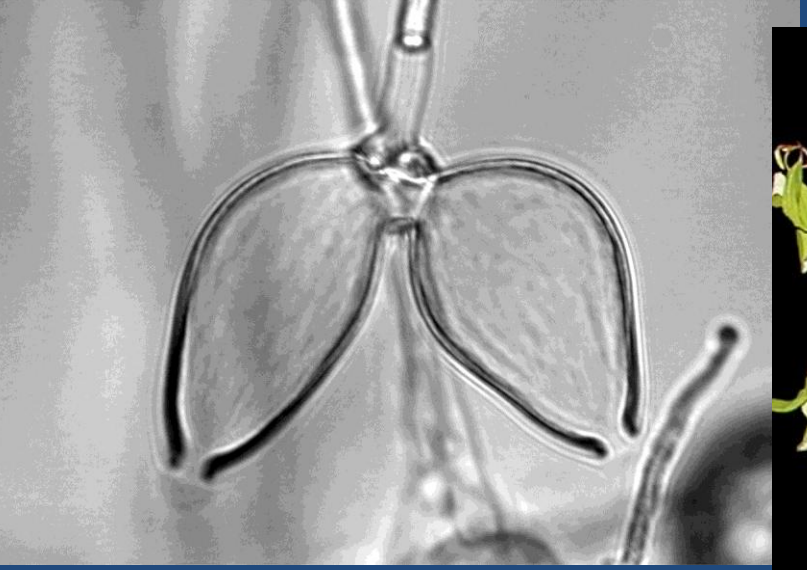
- Voluntary program
- *Phytophthora*-specific
- Focuses on critical control points
  - Soil/potting media
  - Water management
  - Incoming plants
  - Used containers
- Nurseries adopt best management practices
  - Develop mitigation manual
  - Audited to ensure compliance with manual

Poor storage

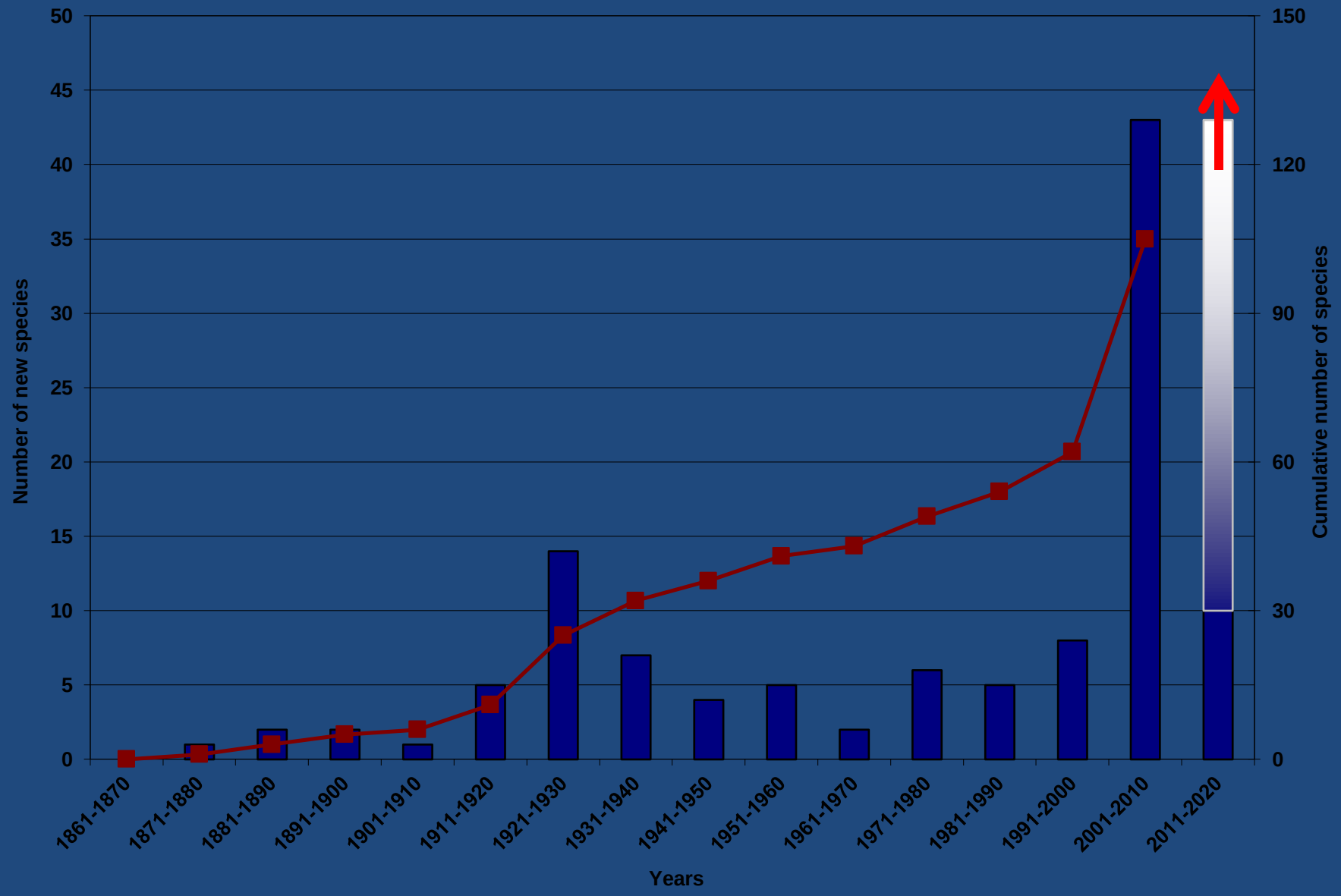
Better storage

ODA file photos

BLUE LEDGE MINE—SUPER FUND SITE



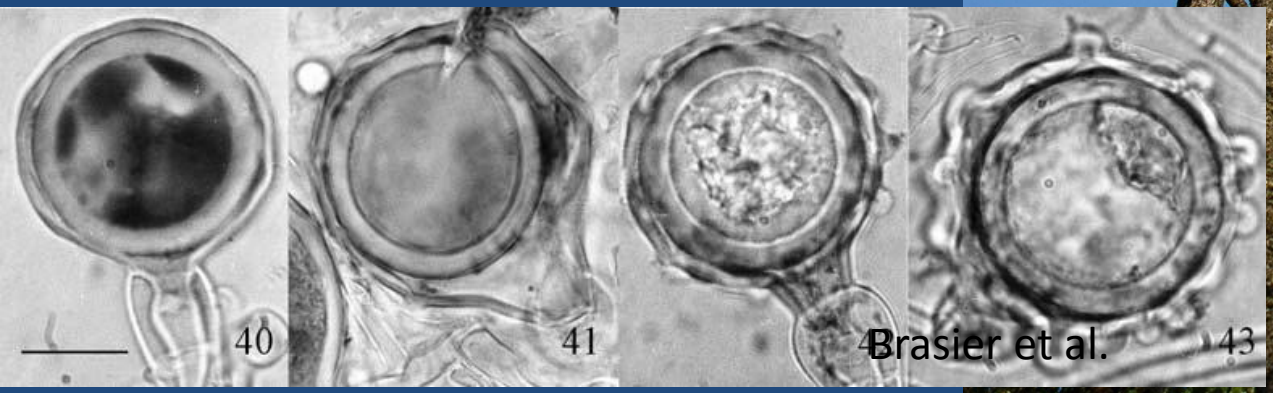
P. Taxon ceanothus


Number of new species
Cumulative number of species
Years
0
5
10
15
20
25
30
35
40
45
50
0
30
60
90
120
150
1861-1870
1871-1880
1881-1890
1891-1900
1901-1910
1911-1920
1921-1930
1931-1940
1941-1950
1951-1960
1961-1970
1971-1980
1981-1990
1991-2000
2001-2010
2011-2020

Symptomatic Alder in the Riparian Zone

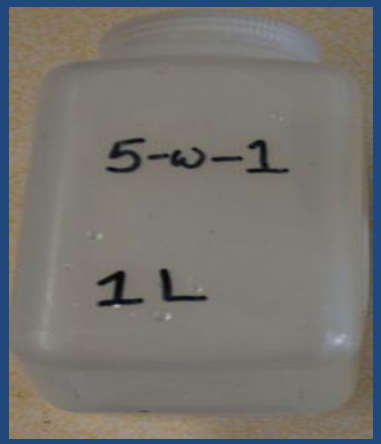
Laura Sims

The Forest Health Monitoring Program
Region 6, Forest Service

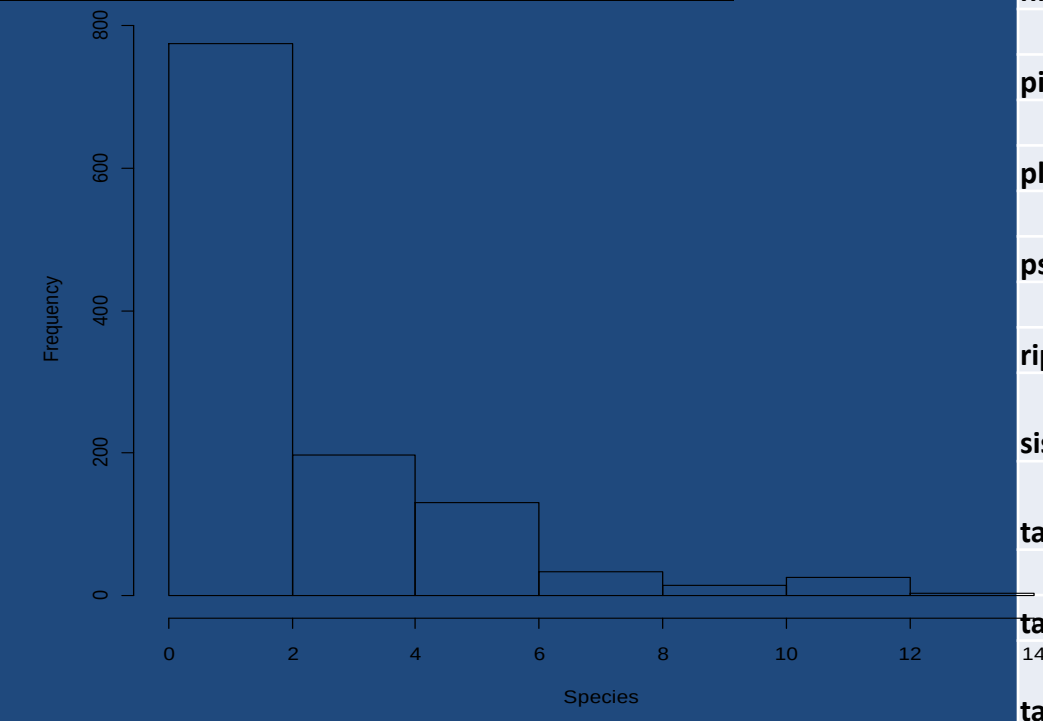


Brasier et al.

ALDER TRANSECT LOCATIONS
2010
Coast Region
Willamette Valley
Southern Region
Astoria
Seaside
Vernonia
Portland
Tillamook
Forest Grove
Pacific City
Lincoln City
Dallas
Salem
Newport
Corvallis
Yachats
Eugene
Florence
Reedsport
Elkton
Coos Bay
Roseburg
Bandon
Port Orford
Gold Beach
Medford
Ashland
Cave Junction
Brookings
0
25
50
Miles


5-w-1
1L

Phytophthora alni var. uniformis



PHYTOPHTHORA SPECIES	HABITAT
alni uniformis	Root
cambivora	Root, Soil
cryptogea	Soil
gallica	Root, Soil, Stream
gonapodyides	Root, Soil, Stream
gregata	Root
hydropathica	Root, Soil, Stream
nicotianae	Stream
pini	Stream
plurivora	Stream, Soil
pseudosyringae	Root, Stream
riparia	Stream
siskiyouensis	Bole, Root, Soil, Stream
taxon oaksoil	Root, Soil, Stream
taxon pgchlamydo	Root, Soil, Stream
taxon salixsoil	Root, Soil, Stream

Host and Habitat Index for *Phytophthora* in Oregon forests (32 Species!)

E journal: Forest Phytophthoras, ISSN: 2164-7232

http://www.forestphytophthoras.org/

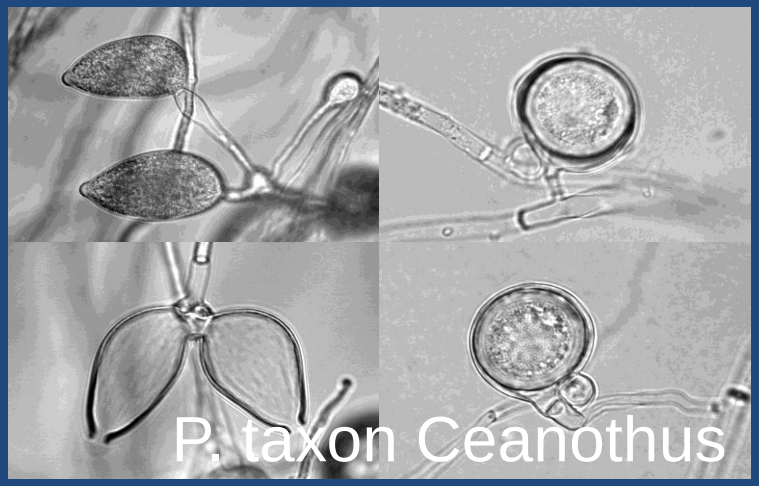
Phytophthora species	Forest Plants	Forest Soil	Forest Streams	Cultivated and Urban[a]
alni uniformis				
cactorum				
cambivora				
cinnamomi				
cryptogea				
europaea				
gallica				
gonapodyides				
gregata				
hydropathica				
ilicis				
lateralis				
megasperma				
multivora				
nemorosa				
nicotianae				
pini				
plurivora				
pseudosyringae				
pseudotsugae				
psychrophyla				
ramorum				
riparia				
sansomeana				
siskiyouensis				
syringae				
taxon ceanothus				
taxon morella				
taxon oaksoil				
taxon pgchlamydo				
taxon pluvialis				
taxon salixsoil				

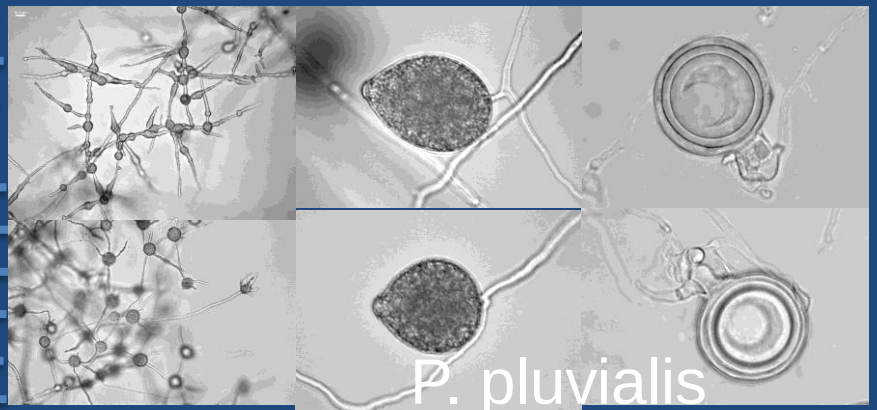
32 Species!

Phytophthora species	Forest Plants	Forest Soil	Forest Streams	Cultivated and Urban[a]
alni uniformis				
cactorum				
cambivora				
cinnamomi				
cryptogea				
europaea				
gallica				
gonapodyides				
gregata				
hydropathica				
ilicis				
lateralis				
megasperma				
multivora				
nemorosa				
nicotianae				
pini				
plurivora				
pseudosyringae				
pseudotsugae				
psychrophyla				
ramorum				
riparia				
sansomeana				
siskiyouensis				
syringae				
taxon ceanothus				
taxon morella				
taxon oaksoil				
taxon pgchlamydo				
taxon pluvialis				
taxon salixsoil				

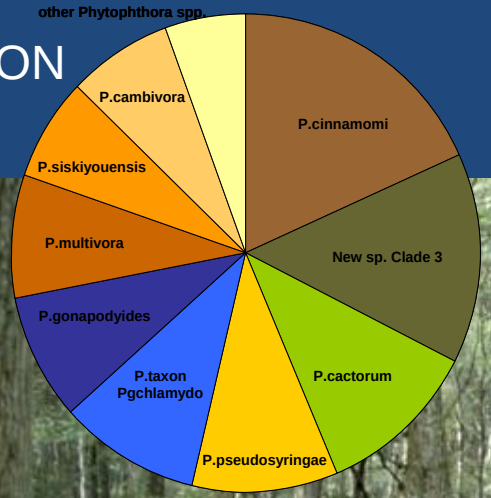
32 Species!

21 "new"

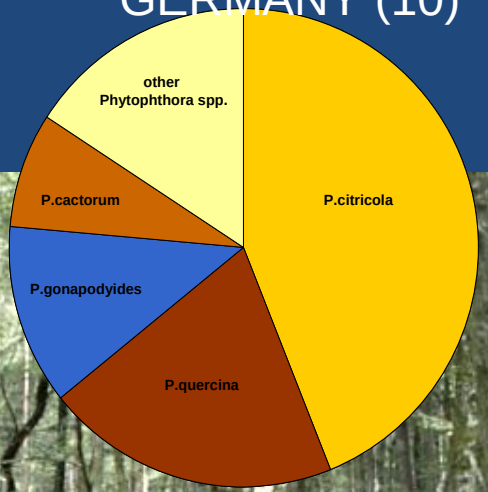




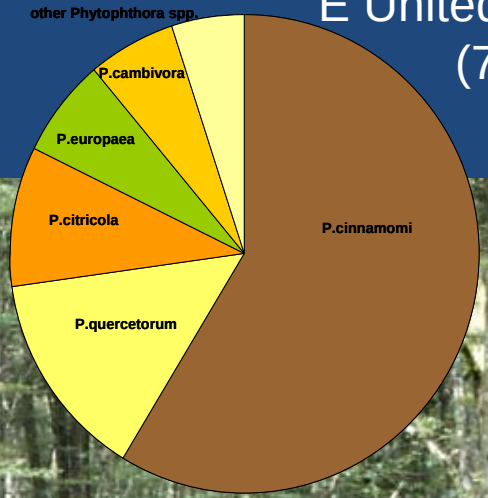
SW OREGON (12)



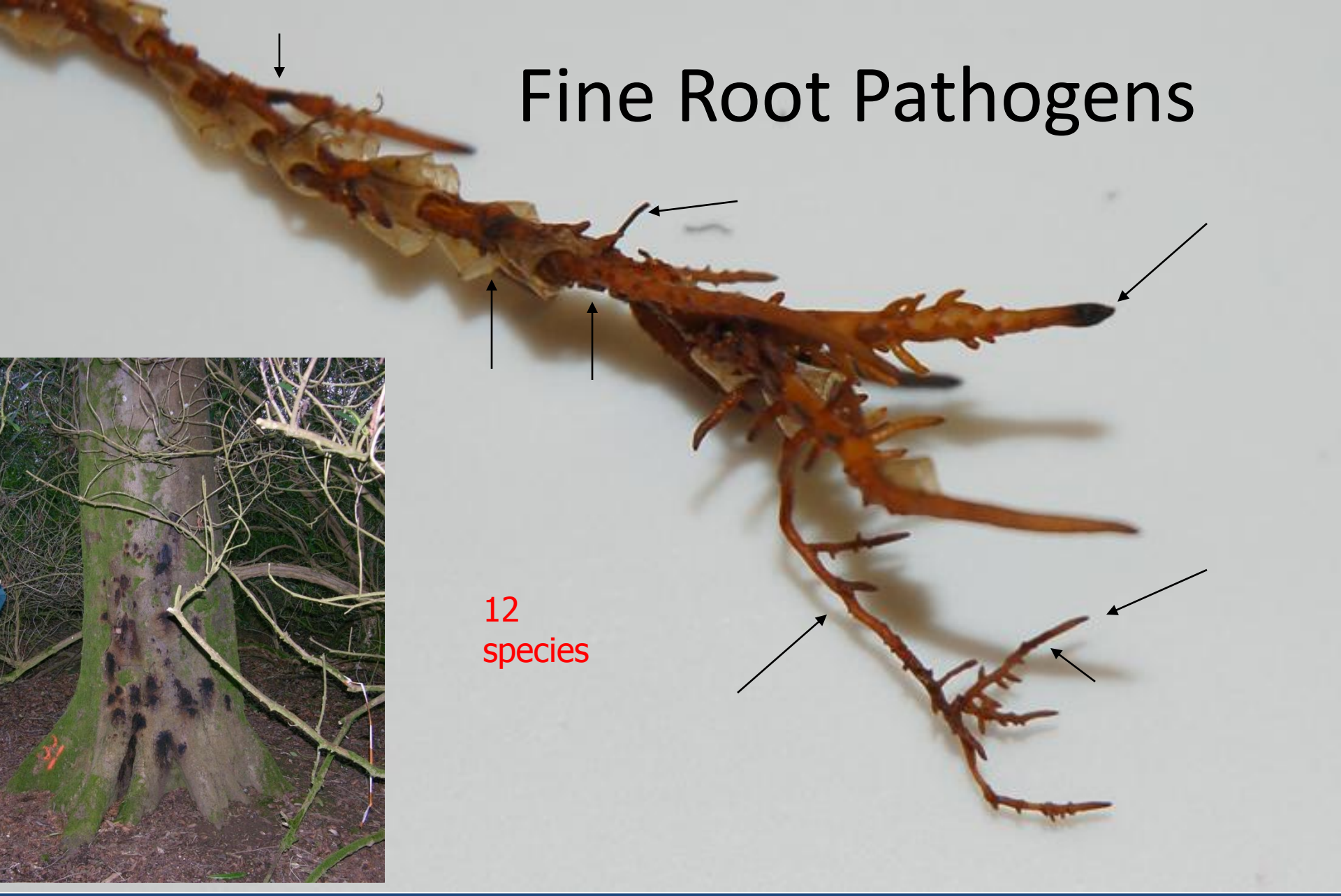
GERMANY (10)



E United States (7)

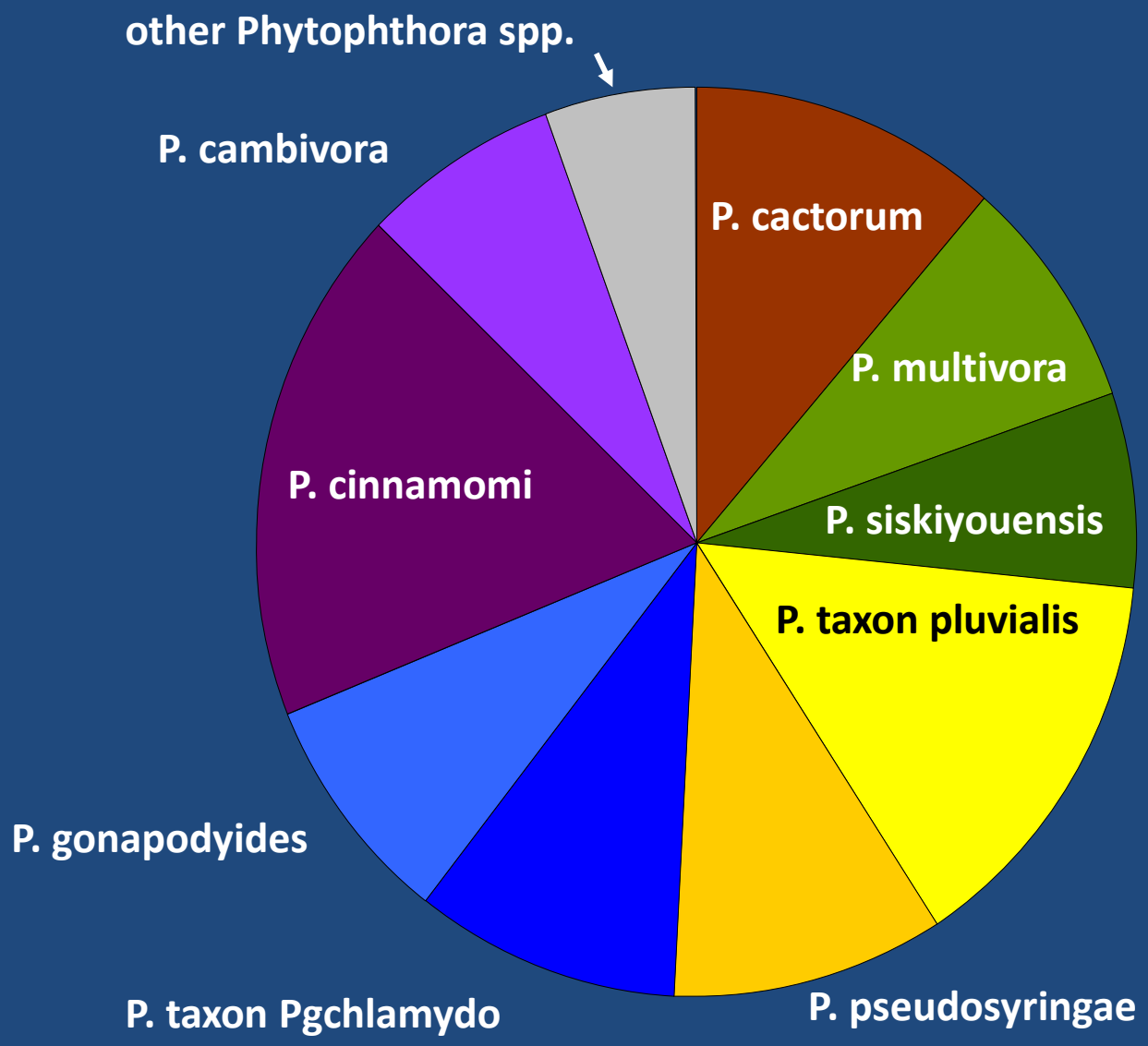


Fine Root Pathogens

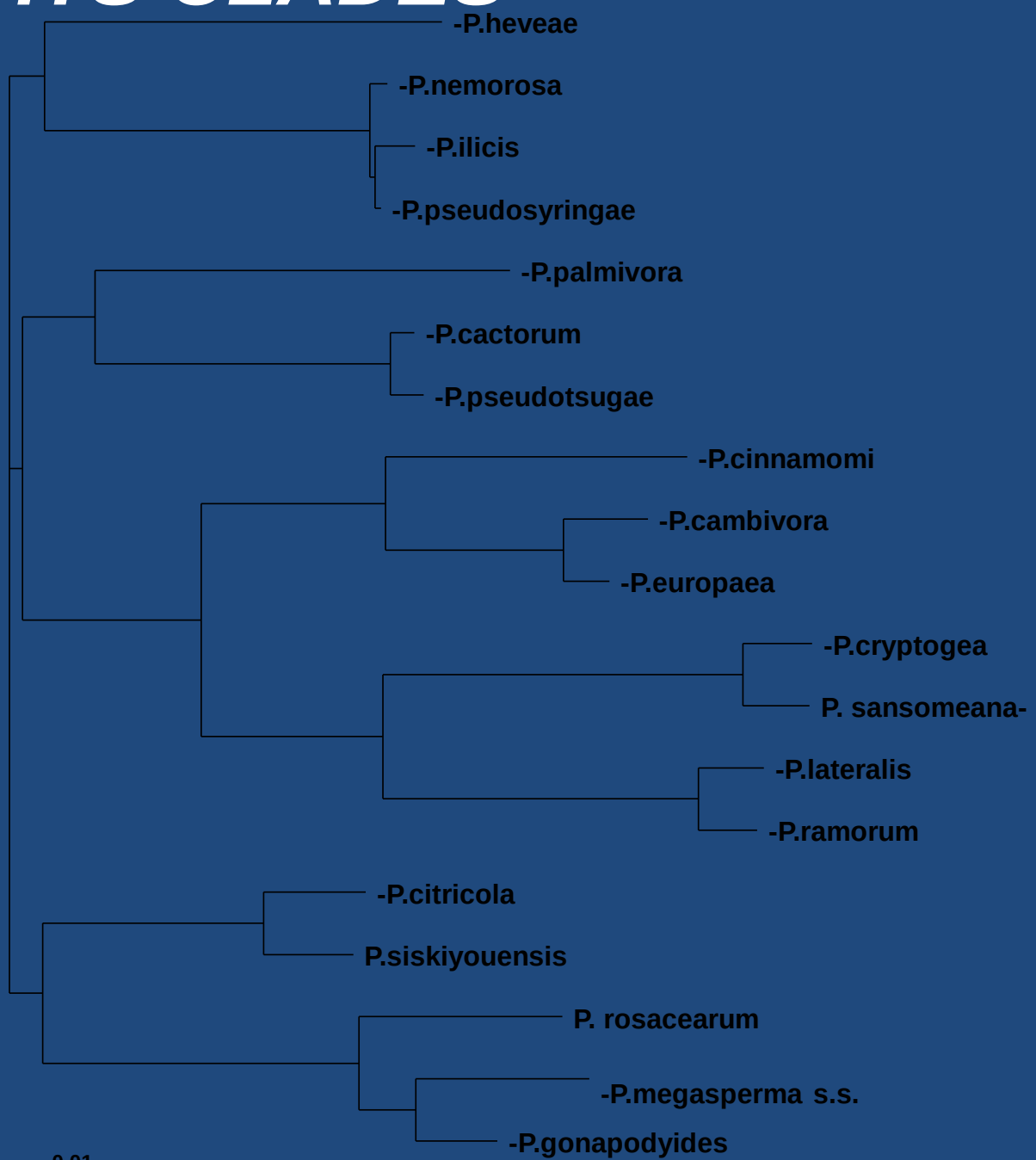


Crown Rot and Bole Cankers

soil


other Phytophthora spp.
P. cambivora
P. cactorum
P. multivora
P. cinnamomi
P. siskiyouensis
P. taxon pluvialis
P. gonapodyides
P. taxon Pgchlamydo
P. pseudosyringae

ITS CLADES



Clade 5

Clade 3

Clade 4

Clade 1

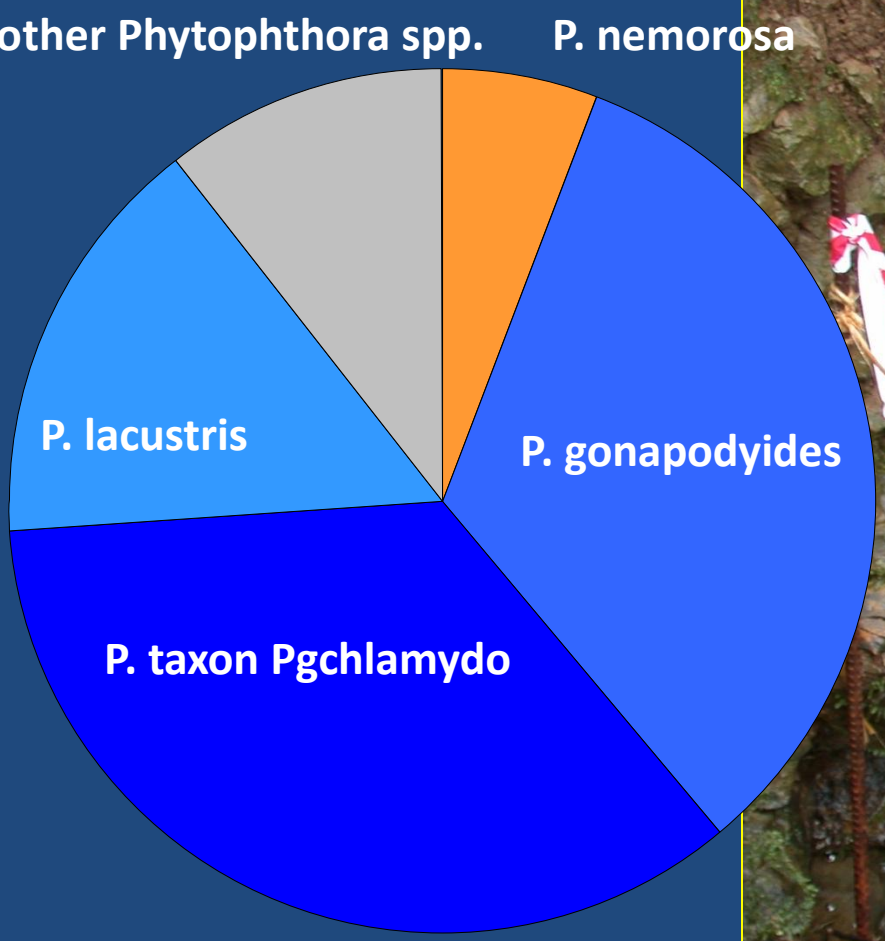
Clade 7

Clade 8

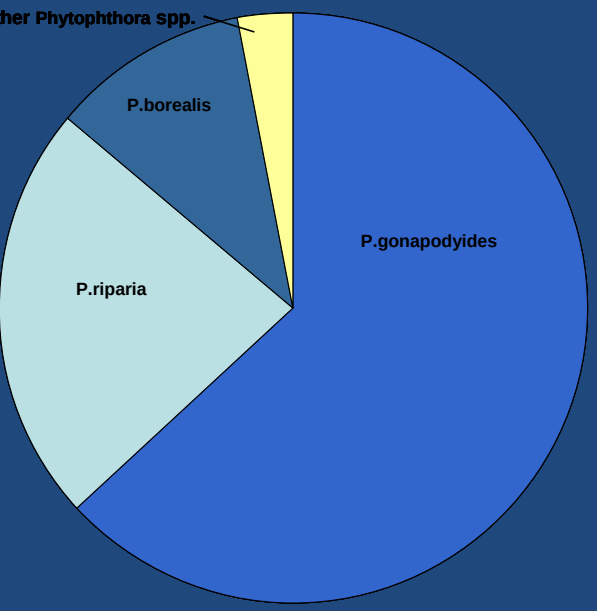
Clade 2

Clade 6

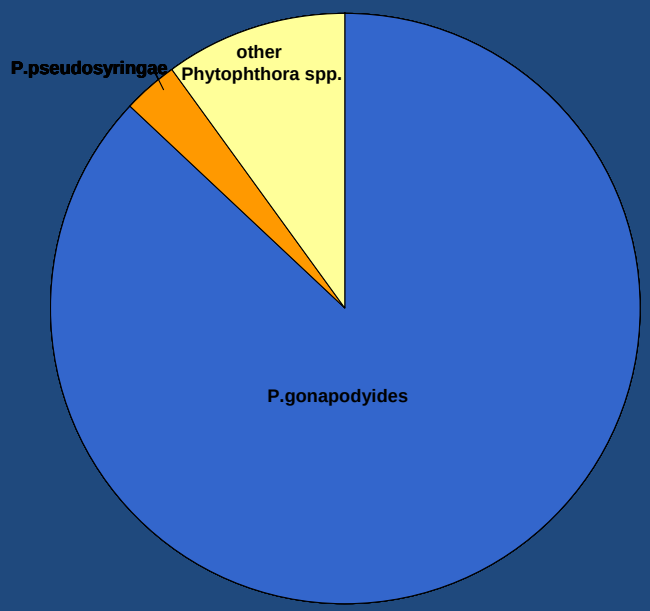
Streams


other Phytophthora spp.
P. nemorosa
P. lacustris
P. gonapodyides
P. taxon Pgchlamydo

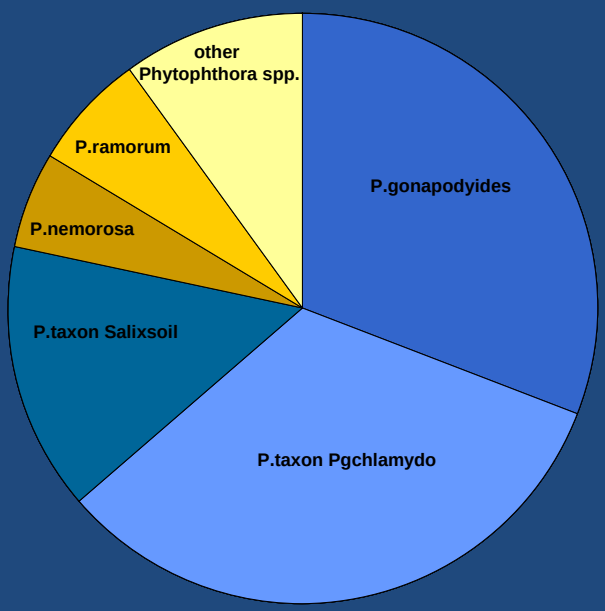
13
species


her Phytophthora spp.
P.borealis
P.riparia
P.gonapodyides

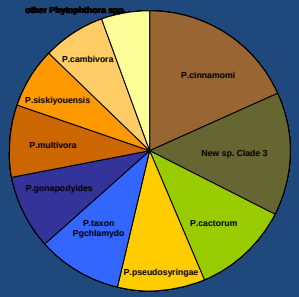
A


P.pseudosyringae
other
Phytophthora spp.
P.gonapodyides

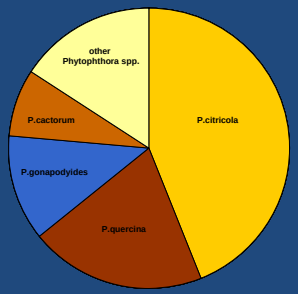
B


other
Phytophthora spp.
P.ramorum
P.nemorosa
P.taxon Salixsoil
P.gonapodyides
P.taxon Pgchlamydo

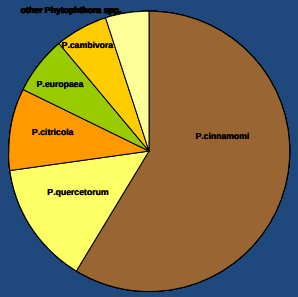
C


other Phytophthora spp.
P.cambivora
P.siskiyouensis
P.multivora
P.gonapodyides
P.taxon
Pgchlamydo
P.pseudosyringae
P.cactorum
New sp. Clade 3
P.cinnamomi

A

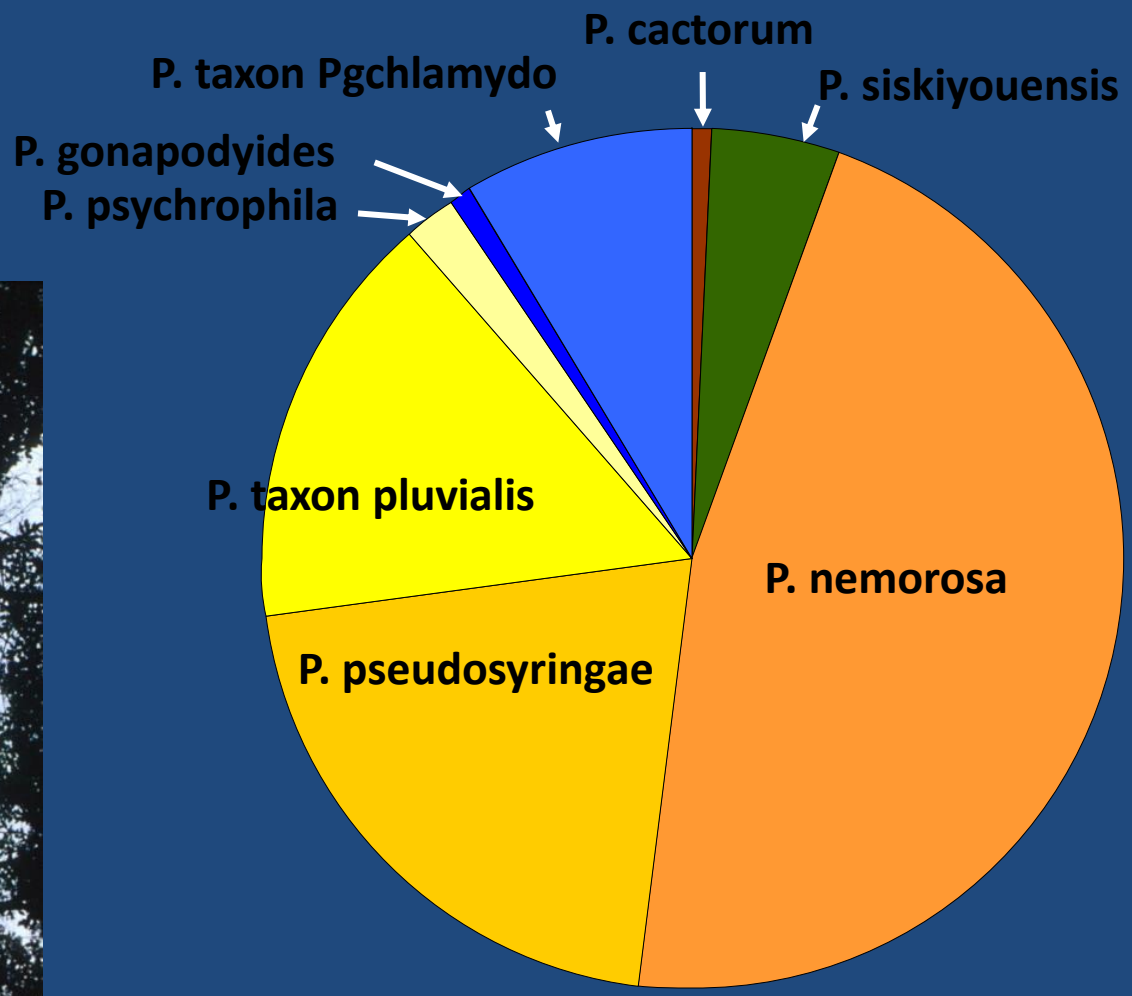

other
Phytophthora spp.
P.cactorum
P.gonapodyides
P.quercina
P.citricola

B


other Phytophthora spp.
P.cambivora
P.europaea
P.citricola
P.quercetorum
P.cinnamomi

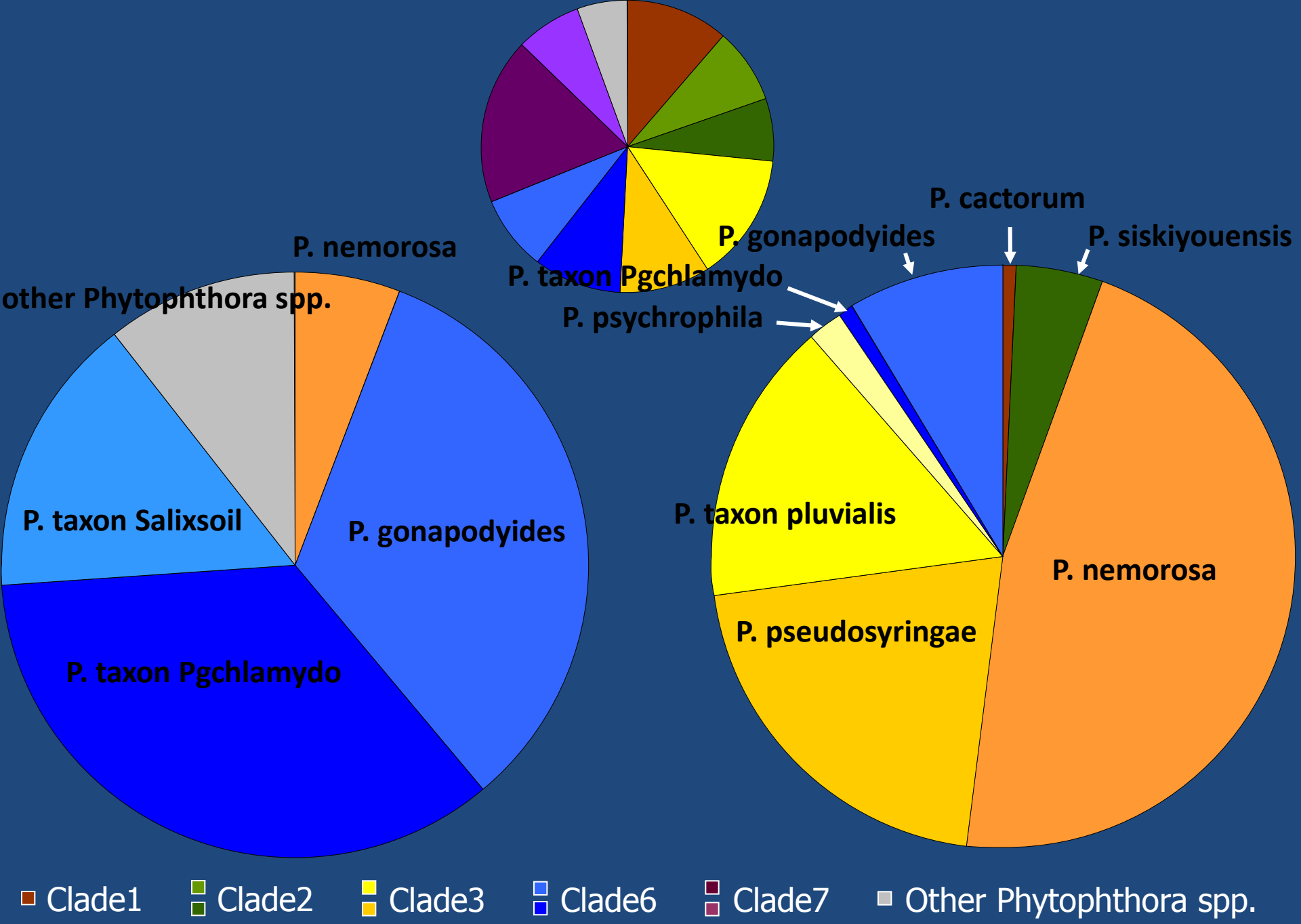
C

Look Up for Phytophthora!



Leaves and Twigs

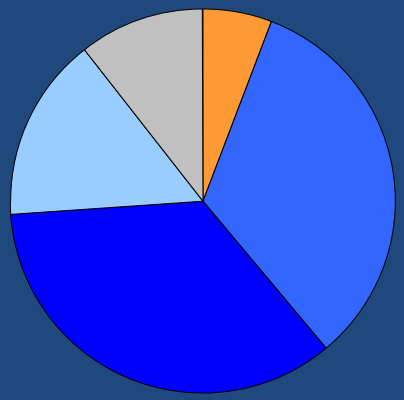
RAIN BUCKETS


P. nemorosa
other Phytophthora spp.
P. taxon Salixsoil
P. gonapodyides
P. taxon Pgchlamydo
P. taxon Pgchlamydo
P. gonapodyides
P. psychrophila
P. cactorum
P. siskiyouensis
P. taxon pluvialis
P. nemorosa
P. pseudosyringae
Clade1
Clade2
Clade3
Clade6
Clade7
Other Phytophthora spp.

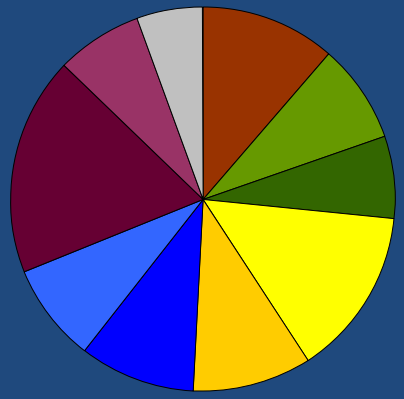
3 “Guilds” of Phytophthora species

In SW Oregon Forests

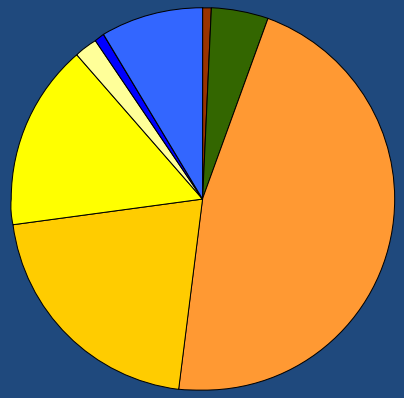
- Streams



- Soil and fine roots



- Leaves and twigs



THANK YOU

Management strategies

- Close down pathways
  - Quarantines
  - *P. ramorum*-free certification
  - Grower programs
- Prevent or limit disease establishment
  - Eradication
    - Nurseries