

# Tree Disease Identification

## Stem and Branch 1:

### Cankers & *Phytophthora* diseases

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# Invasive plant diseases

## Fungi

- Chestnut blight (*Cryphonectria parasitica*) on American chestnut
- White pine blister rust (*Cronartium ribicola*) on Western white pine
- Dutch elm disease (*Ophiostoma ulmi*) on American elm

## Oomycetes

- *Phytophthora cinnamomi* root disease
- Port Orford cedar root disease (*P. lateralis*)
- Sudden oak death and Ramorum blight (*P. ramorum*) on tanoak, oak, larch, many more.

These are capable of eliminating certain host species from an ecosystem



Chestnut blight caused by the fungus *Cryphonectria parasitica*

# Stem and branch diseases 1

- Cankers
- Wetwood
- *Phytophthora*
- Management of canker diseases



# Cankers

- Localized necrosis of the bark and cambium on stems, branches or twigs caused by fungi, bacteria, or abiotic agents.
- Often centered around a wound or branch stub



Cankers on Pacific madrone stem

# Types of Cankers

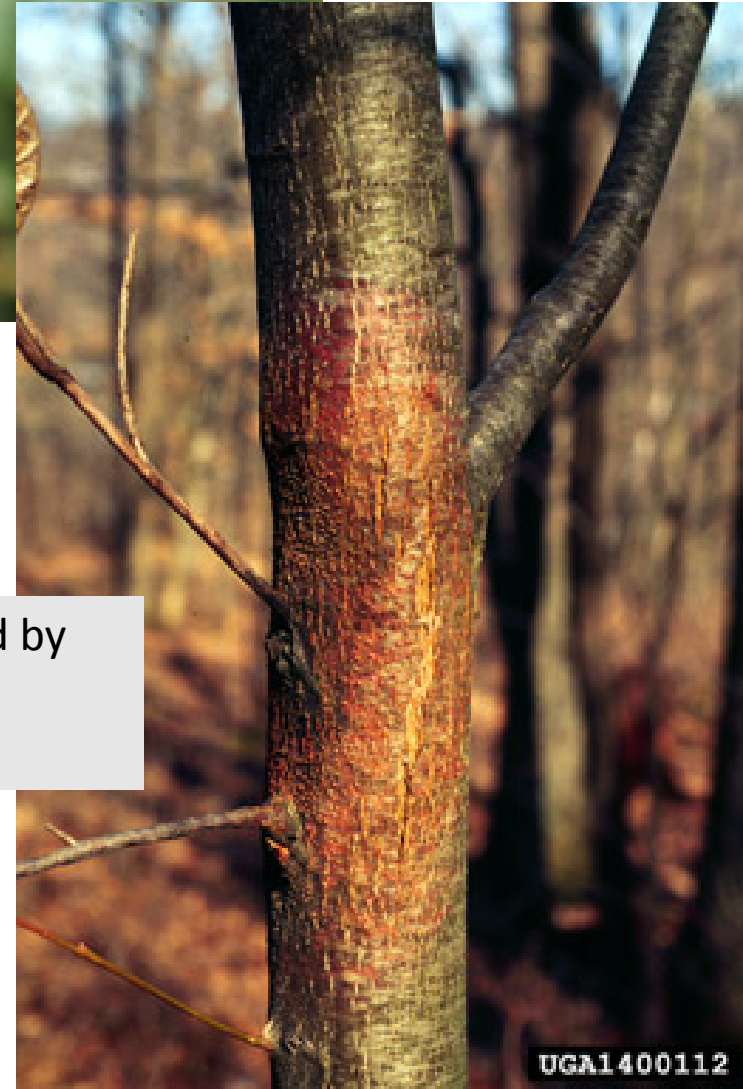
- Annual
- Perennial or Target
- Diffuse



Annual canker caused by *Fusarium* spp.

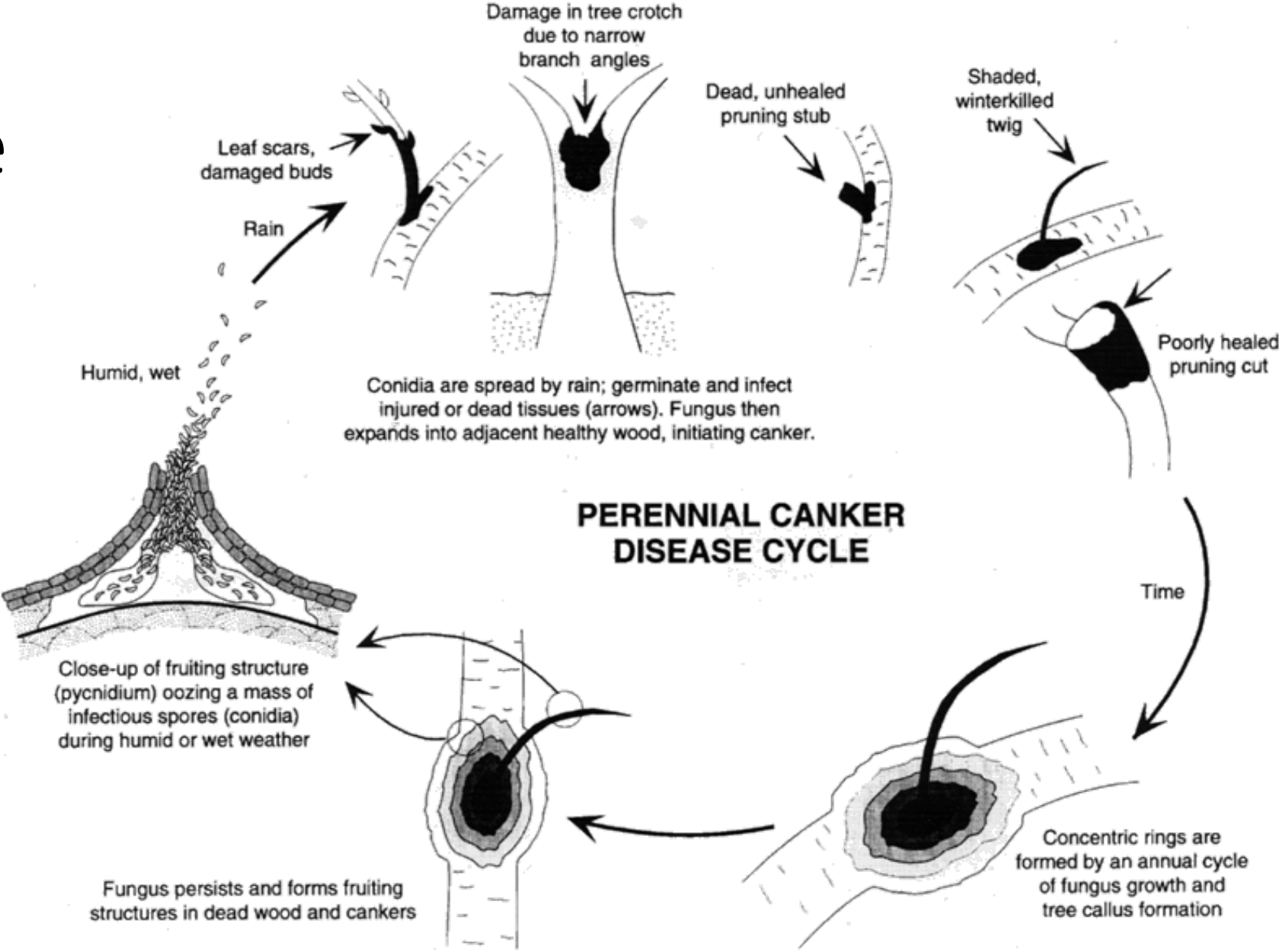


Perennial or "target" canker caused by *Nectria* spp.



Diffuse canker caused by *Endothia parasitica* (chestnut blight)

# Typical life cycle of canker fungi



# *Nectria* canker

Tree hosts: Hardwood -  
maple, apple, pear, plum,  
alder, oak

Conifer- true firs, spruce, pine

Shrubs: rhododendron,  
hydrangea, daphne

Many others



“Target” canker on alder

# *Nectria* canker

- Asexual stage: *Nectria cinnabarina*, *Neonectria galligena*, *Neo. ditissima*
- Sexual stage: *Tubercularia*



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Fruiting bodies (sporodochia) on spruce and maple



# Apple anthracnose and canker



- Hosts: Apple (*Malus* spp.), mountain ash (*Sorbus sitchensis*), hawthorn (*Crataegus* spp.)
- Pathogens:
  - Anthracnose: *Cryptosporiopsis curvispora*:  
(sexual: *Neofabraea malicorticis*)
  - Perennial canker: *Cryptosporiopsis perennans*  
(sexual: *Neofabraea perennans*)

# Apple anthracnose

- Annual canker, but fungus fruits for 2-3 yr in dead tissue
- Look for stringy detached bark
- Bulls-eye rot on fruit



# Perennial canker of apple

- Perennial “target” canker
- Associated with woolly apple aphids
- Same bulls-eye fruit rot as with anthracnose



# *Botryosphaeria* Canker

Tree Hosts: madrone,  
maple, apple, cherry

Shrub hosts:  
rhododendron, vaccinium,  
other Ericaceae

Staining under bark on apple



Canker and dieback on madrone

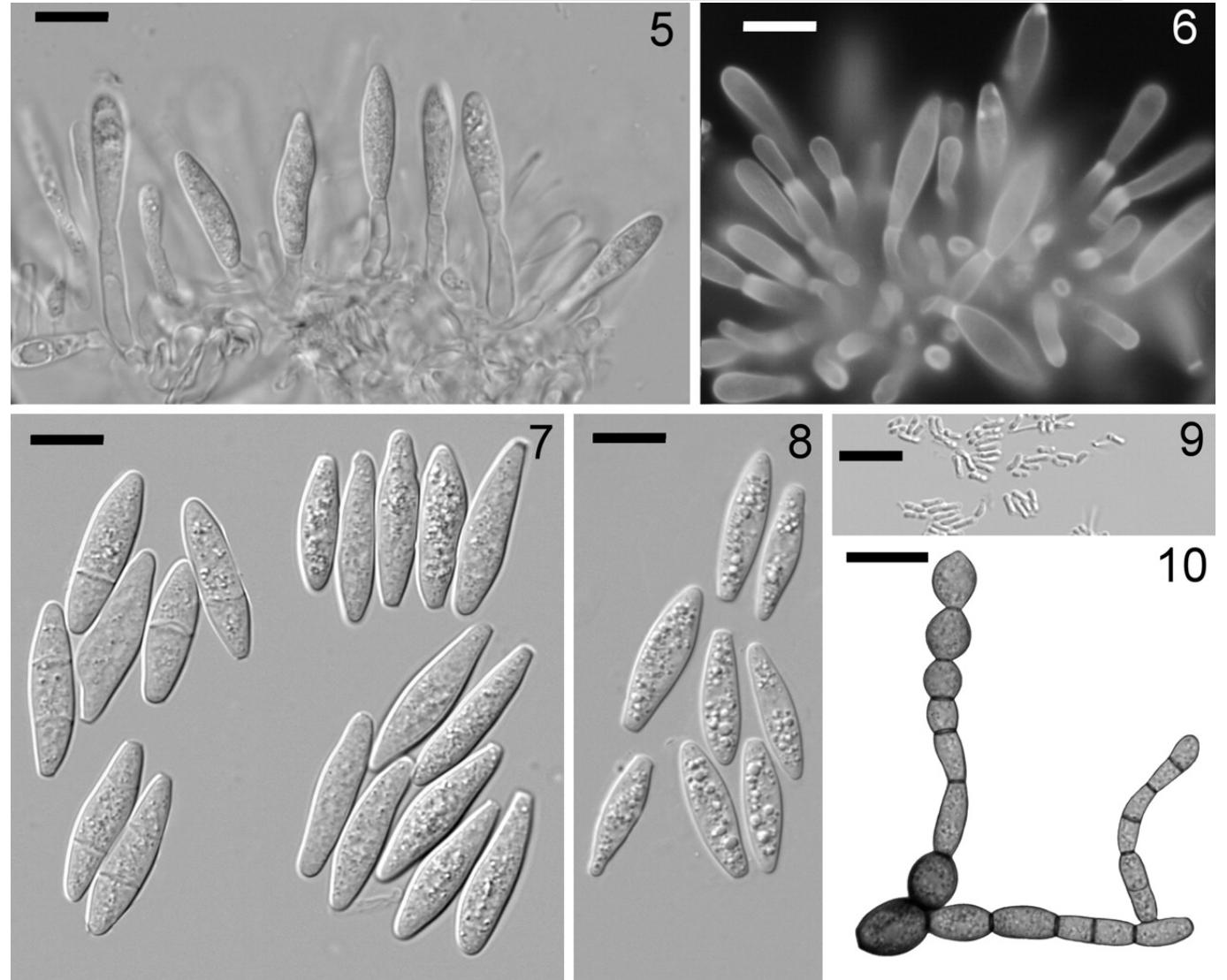


# *Botryosphaeria* canker

Pathogens: *Botryosphaeria arctostaphyli*, *B. berengeriana*, *B. philoprina*, *B. ribis*, *B. trames*, *B. vaccinii*  
(Ascomycetes)

Asexual stages in *Fusicoccum*, *Neofusicoccum*, *Phyllosticta*

Spores of *N. arbuti* from madrone



# *Eutypa* canker

- Hosts: *Prunus*, *Alnus*, *Acer*
- Pathogens: *E. armeniaca*,  
*E. flavovirens*



V-shaped canker caused by *Eutypa lata* in the xylem of a grapevine cordon.



# *Eutypa* vs *Botryosphaeria*

Both have

- V-shaped cankers in xylem
- Sooty appearance of cankered wood
- Branch dieback

Pycnidia sliced open to reveal white interior

*Botryosphaeria* (*Fusicoccum*)



*Eutypa*



Perithecial cavities, demonstrating a shiny inner surface characteristic of mature, dry perithecia.

# Eastern filbert blight

- Hosts: hazelnuts (*Corylus* spp.)
- Pathogen: *Anisogramma anomala*



Eastern filbert blight is also a disease on the ornamental contorted filbert.

Photo by Jay W. Pscheidt, 1996.

Symptoms take 2 years to develop

For more information

<http://pnwhandbooks.org/plantdisease/hazelnut-corylus-avellana-eastern-filbert-blight>



# *Eutypella* canker

Hosts: Alder, birch, maple

Pathogen: *Eutypella cerviculata*, *E. angulosa*,  
*E. alnifraga* (Ascomycetes), *E. parasitica* on  
maples, not reported in WA



# *Cytospora* canker

Hosts: many hardwoods including maples, birch, chestnut, ash, pear, elderberry, mountain ash,

Conifers: douglas-fir and western red cedar

An opportunist, symptoms severe on stressed trees

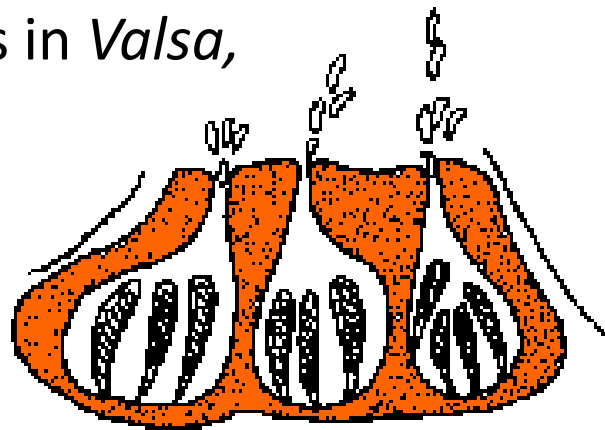


Symptoms on apple

# *Cytospora* canker

Pathogens: *Cytospora chrysosperma*, *C. mollissima*,  
*C. thujae*, *C. kunzei*  
(Ascomycetes)

Sexual stages in *Valsa*,  
*Leucostoma*



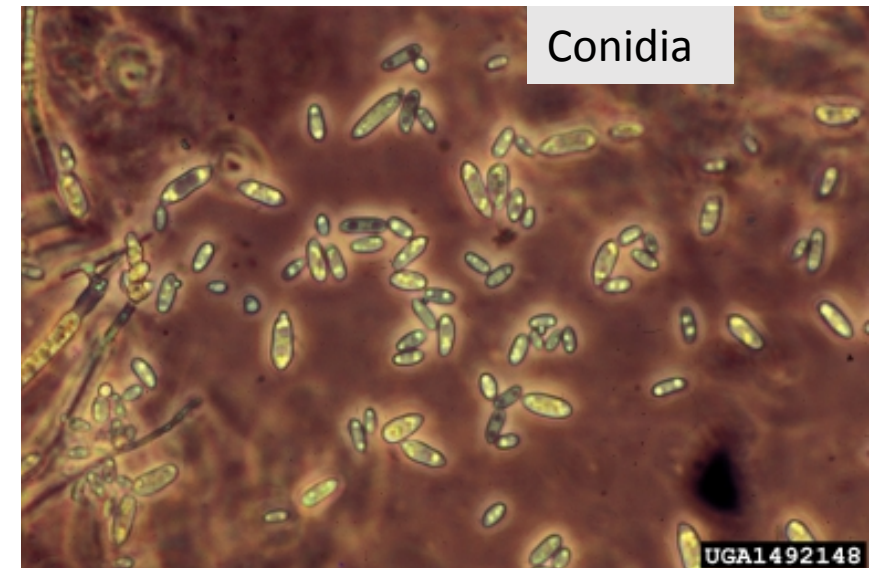
*Valsa* - type  
perithecia



*Cytospora* - type pycnidia  
extruding tendril of spores



Yellow spore masses oozing from  
pycnidial stroma



Conidia

UGA1492148

# *Cryptodiaporthe* canker of poplar

- Hosts: Lombardy poplar (most susceptible), other *Populus* spp.
- Pathogen: *Cryptodiaporthe populea* (Ascomycetes)  
**not reported in WA**



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Conidia

20.0  $\mu\text{m}$

5528611



Fruiting bodies

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# Canker rots

Hosts: many hardwoods including maples, willow, poplar, alder, oak

Pathogens: *Hypoxylon* spp.

An opportunist, symptoms severe on stressed trees

Tree failure from decay caused by Hypoxylon canker



# Bacterial canker

Hosts: stone fruits (cherries, peaches, etc)

Pathogen: *Pseudomonas syringae*

The bacterial infection causes gummosis on branches and stems and can also cause fruit rot.



# Bacterial Wetwood

Occupies the **heartwood** of some tree species

- conifers: firs and hemlocks primarily
- hardwoods: elms, poplars, birches, oaks
- Bacteria feed on sap, lowering O<sub>2</sub> and creating anaerobic environment, raising pH, and generating methane
- These conditions help defend the tree from decay fungi.



Bacterial wetwood and slime flux on elm tree at UW arboretum, Seattle, WA

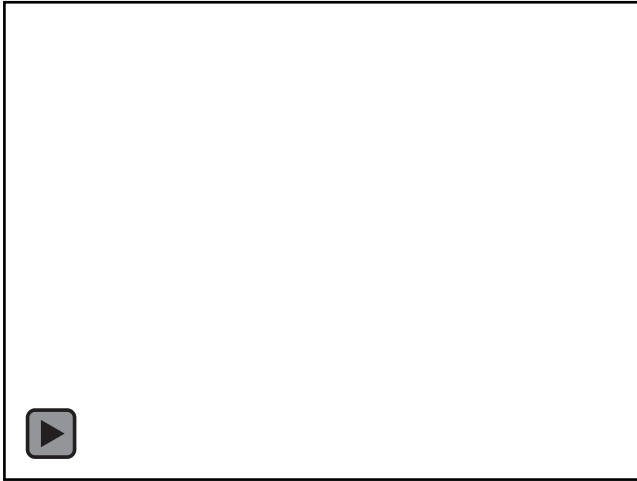
# Managing bacterial wetwood

- Avoid soil compaction and wounding
- Drilling holes to relieve pressure does not help!
- Sometimes insects are attracted to slime flux

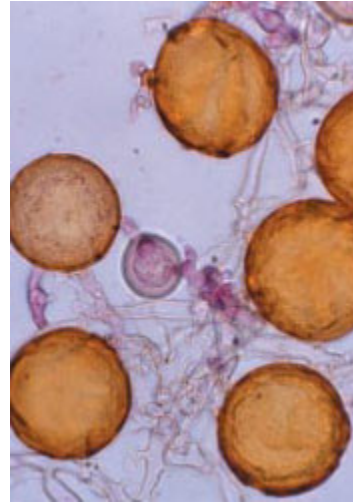




# *Phytophthora*

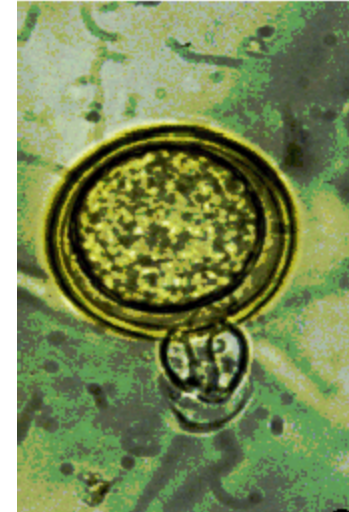


Sporangia containing swimming zoospores



Chlamydospores

Sexual stage



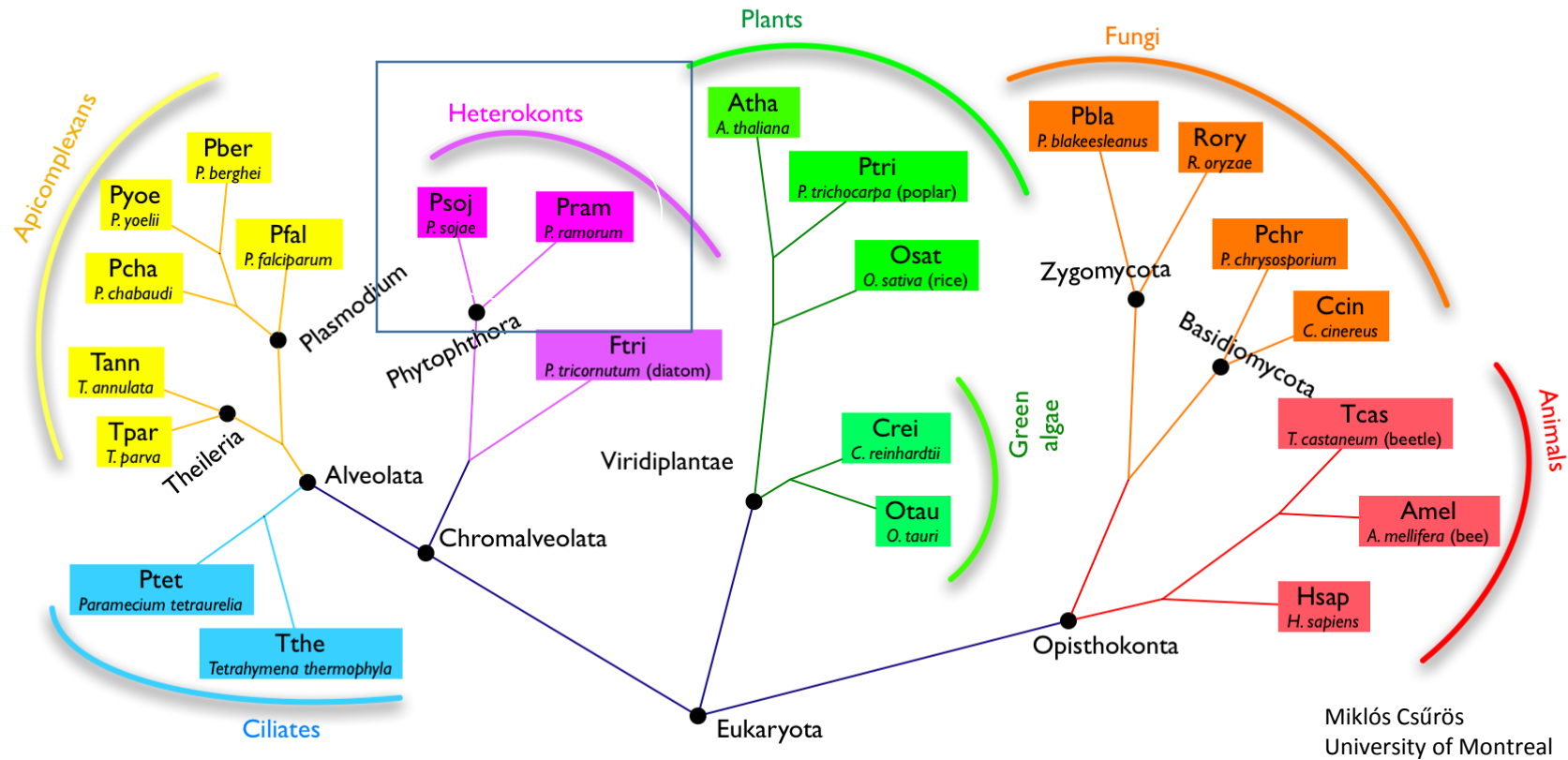
Oospores (*P. infestans*)

*Phytophthora* is microscopic and species can be identified by spore stages and/or DNA sequencing

Heterothallic – requires two mating types for sexual recombination

Homothallic – sexual recombination within the same individual (selfing)

# Phytophthora is not a fungus



- Oomycetes were once considered to be fungi
- Fungi and Oomycetes have similar growth forms – convergent evolution
- Control agents for fungi may not work for Oomycetes and vice-versa

# Aquatic *Phytophthora* spp

Common in waterways

Weak pathogens

- *P. chlamydospora*
- *P. lacustris*
- *P. gonapodyides*

Any *Phytophthora* species can be detected using immunostrips, not all are aggressive pathogens.



# *Phytophthora* canker

- Bleeding
- No callus margin
- Brown staining under bark
- May come up from roots
- Best ID'd from host range, symptoms

*P. cambivora* – many hosts

*P. cinnamomi* – *Eucalyptus* and others

*P. alni* ssp. *alni* – alder

*P. lateralis* – Port Orford cedar

*P. ramorum* – Sudden Oak Death



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# *P. cambivora*

Host range: Conifers and hardwoods

Geographic range: Europe and North America

Origin: unknown

Important diseases: Ink disease of hardwoods, root rot on *Abies* spp.

- Root disease & basal canker
- Heterothallic



*P. cambivora* causing dieback on European beech (*Fagus sylvatica*) in Germany

# *P. cinnamomi*

Host range: Hardwoods and conifers – more than 1,000 species

Geographic range: worldwide

Origin: Indonesia

Important diseases: Chestnut ink disease, ink disease of oaks, Jarrah dieback of eucalyptus, Avocado root rot, littleleaf disease of pine

- Root disease & basal canker
- More aggressive in warm soils
- Heterothallic



*P. cinnamomi* on Pacific madrone, CA

# *P. alni ssp. alni*

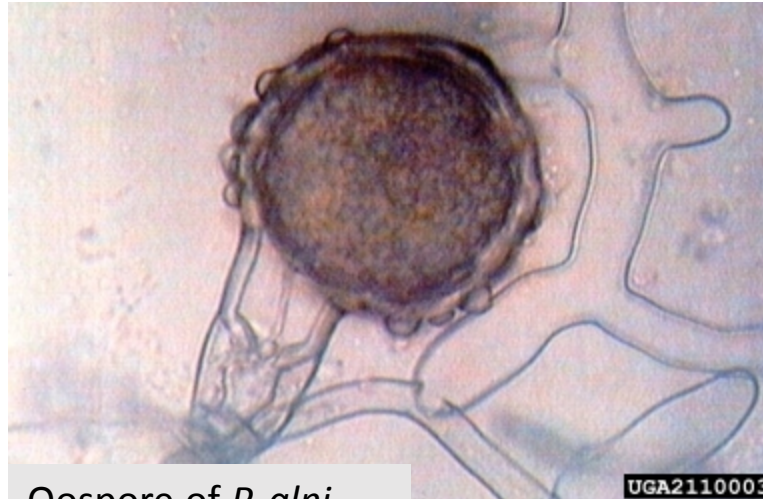
Host range: *Alnus* spp.

Geographic range: UK, 18 European countries

Origin: UK

Important diseases: Alder root rot

- Root disease & basal canker
- Homothallic
- Hybrid of *P. alni ssp. uniformis* and *P. alni ssp. multiformis*, which are hybrids of *P. cambivora* and *P. fragariae*



Oospore of *P. alni*

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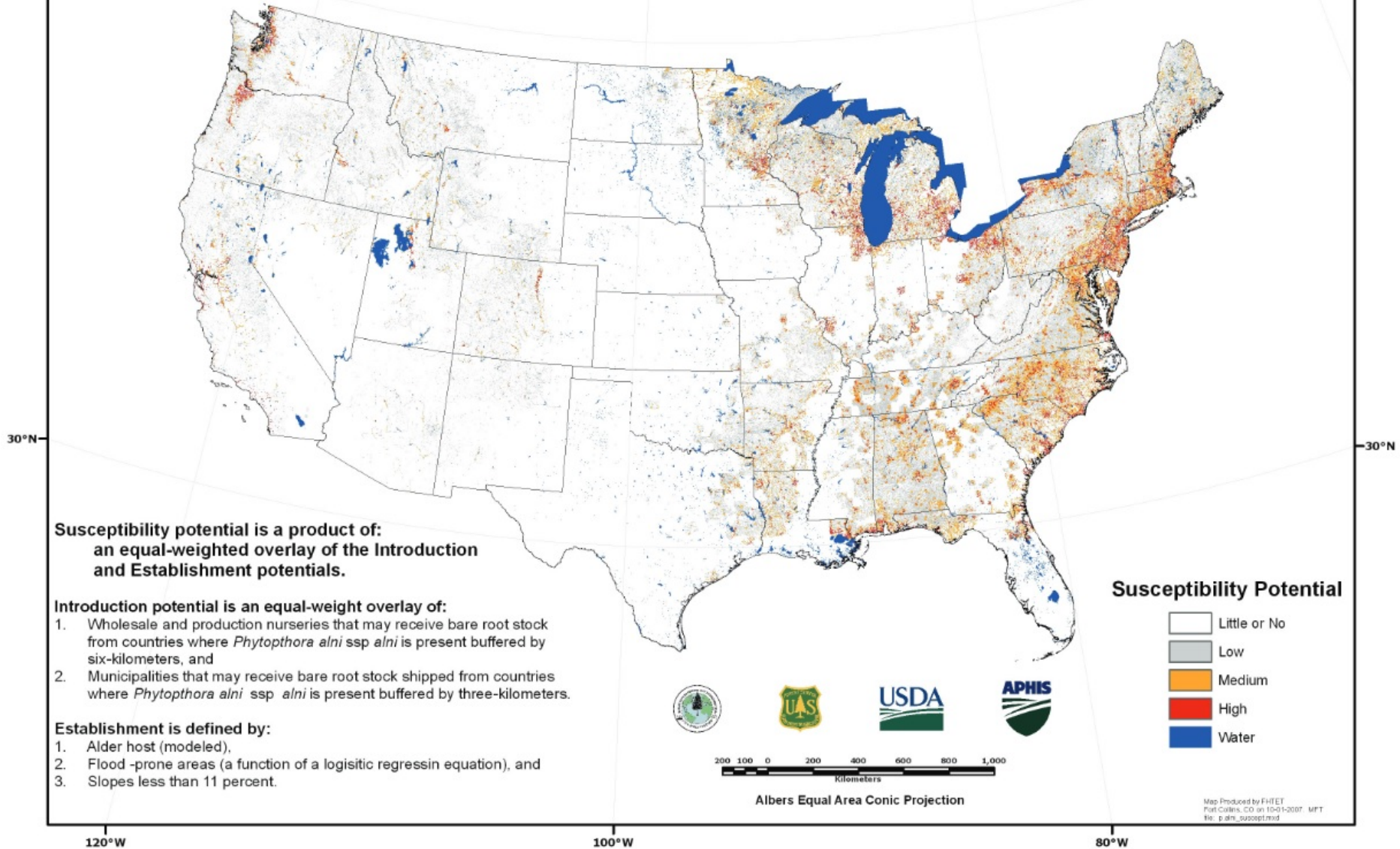


Mature common alder (*A. glutinosa*) with collar rot by *P. alni* (note tarry spots at the outer bark) growing in a forest stand in Germany; introduction of the pathogen via alder plantation in the neighbourhood established with infested planting stock.

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# Susceptibility Potential

*Phytophthora alni* ssp *alni*  
10-01-2007



**Susceptibility potential is a product of:  
an equal-weighted overlay of the Introduction  
and Establishment potentials.**

**Introduction potential is an equal-weight overlay of:**

1. Wholesale and production nurseries that may receive bare root stock from countries where *Phytophthora alni* ssp *alni* is present buffered by six-kilometers, and
2. Municipalities that may receive bare root stock shipped from countries where *Phytophthora alni* ssp *alni* is present buffered by three-kilometers.

**Establishment is defined by:**

1. Alder host (modeled),
2. Flood-prone areas (a function of a logistic regression equation), and
3. Slopes less than 11 percent.



Albers Equal Area Conic Projection



# *Phytophthora lateralis*

Host range: Port-Orford cedar  
(*Chamaecyparous lawsoniana*), *C. obtusa*,  
Pacific yew (*Taxus brevifolia*), *Thuja*  
*occidentalis*

Geographic range: UK, France, Netherlands,  
Pacific Northwest, Taiwan

Origin: Possibly Taiwan

Important diseases: Port Orford cedar root  
disease

- Root disease & basal canker
- Heterothallic



Aerial infections in France  
and coastal Oregon.



Breeding program for  
resistant POC in Oregon

Mortality from *P. ramorum* infection at China Camp State Park, CA.

# *P. ramorum*

Host range: more than 100 hosts

Geographic range: CA, OR, WA, UK, Europe

Origin: Unknown

Important diseases: Sudden oak death, Ramorum blight

- Canker and foliar blight
- Aerial infections
- Heterothallic
- Regulated

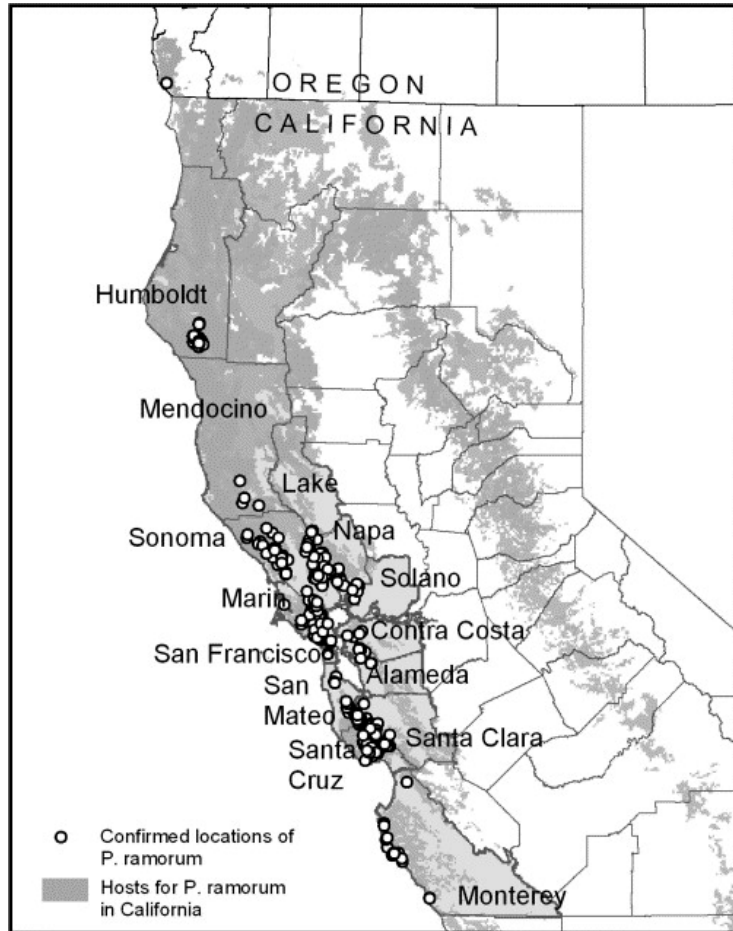


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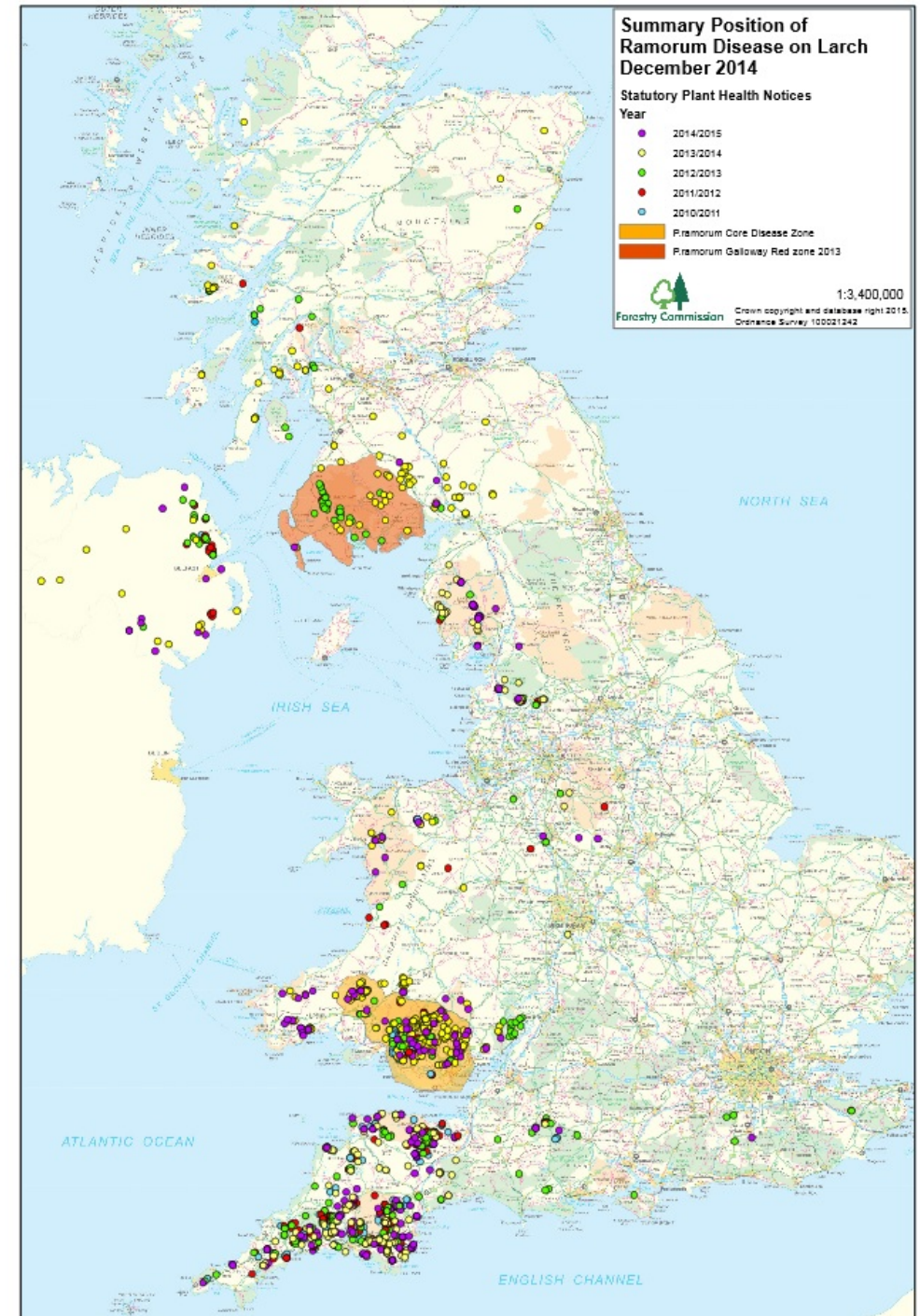


Ramorum blight on *Camellia sinensis* 'Sochi' in nursery

# *P. ramorum* distribution in forests



Western US – oak, tanoak

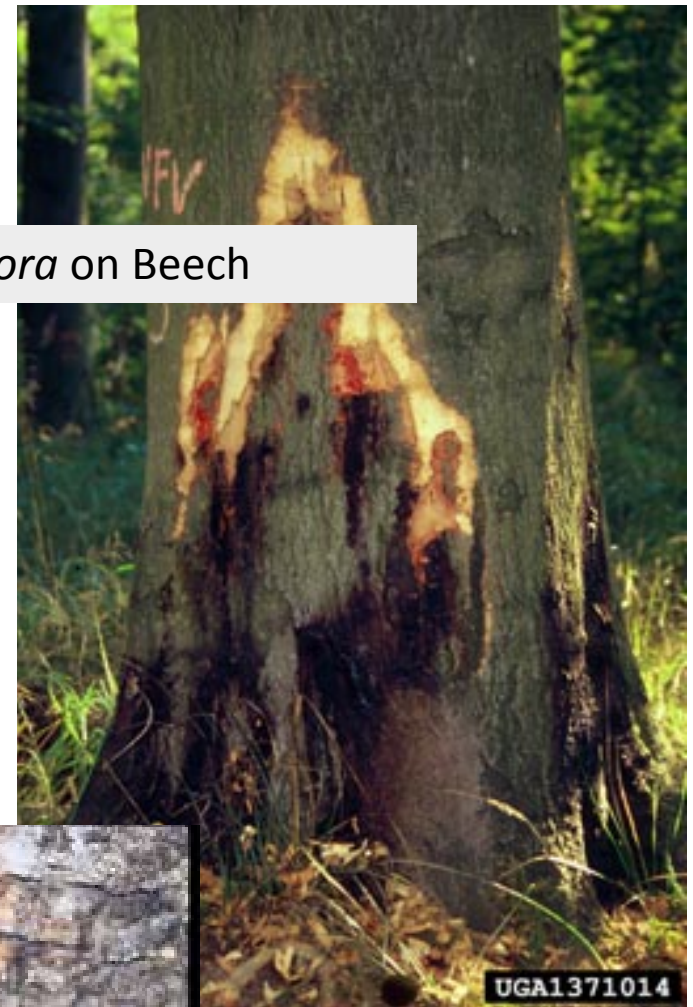


UK - larch

# SOD symptoms on trees

- Bleeding cankers
- Cankers can girdle the tree and kill it
- Host species in Fagaceae: oaks, beech, tanoak
- Other *Phytophthora* spp can cause the same symptoms

*P. cambivora* on Beech



*P. ramorum* on Oak

# Managing canker diseases

- Moisture control
- Prune in dry weather
- Sanitation – pruning tools, weed control, remove dead material
- Prevent or reduce wounding, including sunscald and winter injury to trunks
- Improve tree vigor
- Preventative chemical treatment on high value trees