



# Overview of Common Needle Diseases

**BRENT OBLINGER**

**FOREST PATHOLOGIST**

**USDA FOREST SERVICE**

**CENTRAL OREGON SERVICE AREA**

# General Characteristics

- ▶ Typically not mature tree killers and not a big management concern in most situations. May cause growth loss.
- ▶ Can threaten or impede regeneration at times though, and young trees may not survive repeated defoliation. Can be more of a problem in nurseries or Christmas tree plantings.
- ▶ Most of the common foliage diseases are caused by native fungi.
- ▶ Life cycles of the fungal pathogens often coincide with host phenology.
- ▶ Incidence and severity of needle diseases are strongly influenced by seasonal weather patterns.
- ▶ Some fungi may damage stems of shoots too and not just foliage.
- ▶ Other causes of needle damage include: salt injury, herbicides, winter or frost injury, drought, air pollution, too much fertilizer.

# Common symptoms of needle diseases

- ▶ Thin crown
- ▶ Yellowing crown
- ▶ “Scorched” appearance from reddening foliage
- ▶ Early loss of foliage (“cast”)/premature defoliation. Often in inner and lower crown.
- ▶ Missing needles in specific age classes of foliage
- ▶ “Bottle brush or lion’s tail” appearance throughout the crown



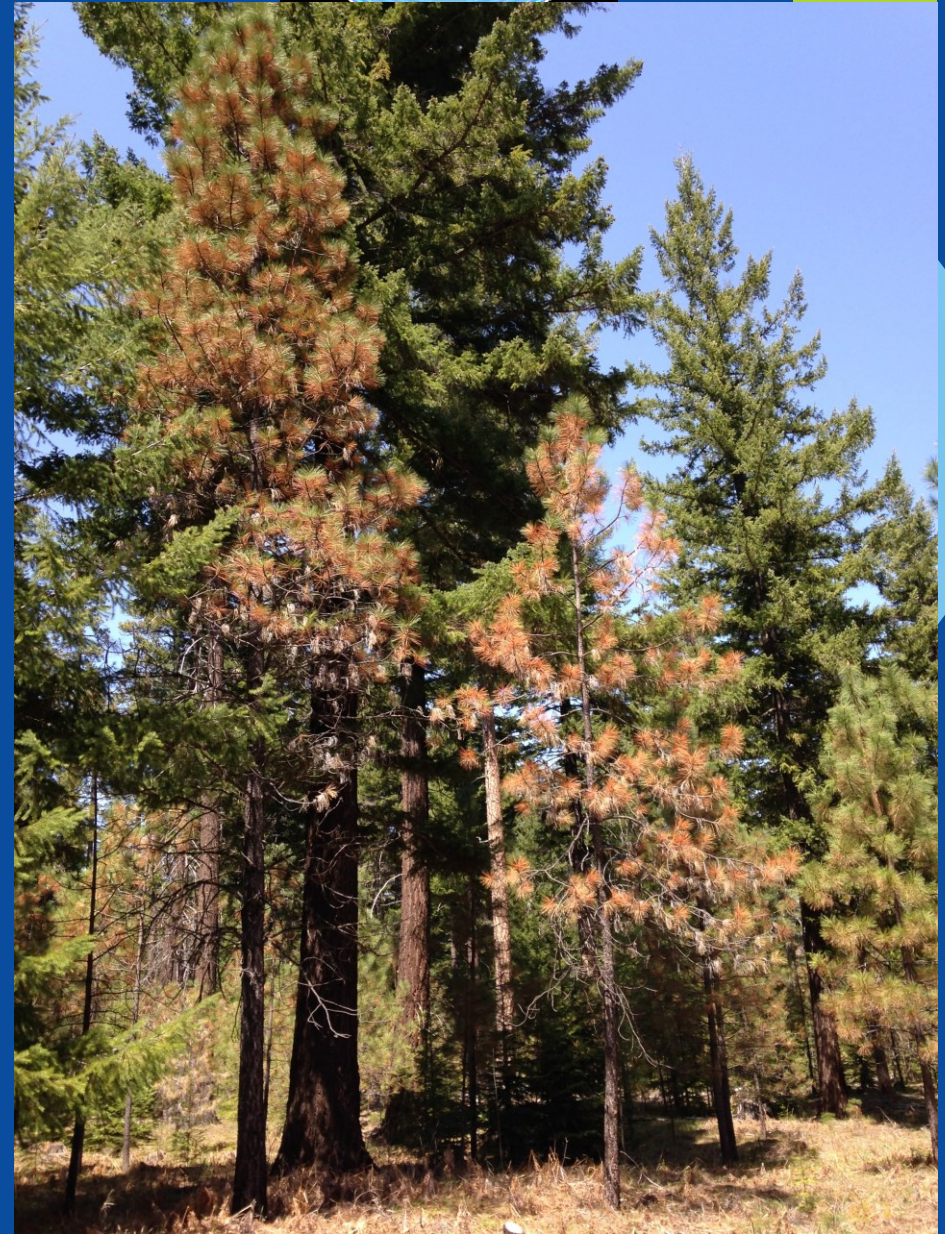
(Photo: Jane Taylor)

Lophodermella needle cast on lodgepole pine



# Common symptoms of needle diseases

- ▶ With many needle diseases, missing needles in specific age classes of foliage





# Bottlebrush or lion's tail symptoms



(Photo: James Worrall)



# Diagnosing foliage diseases

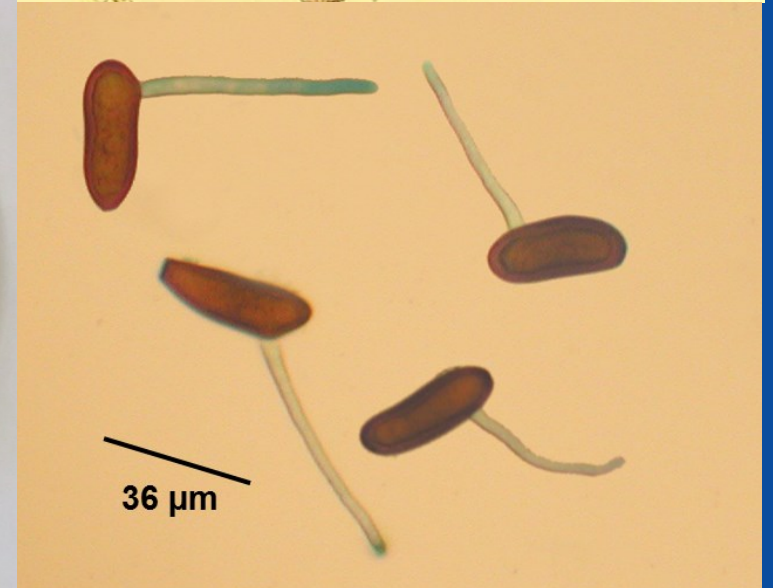
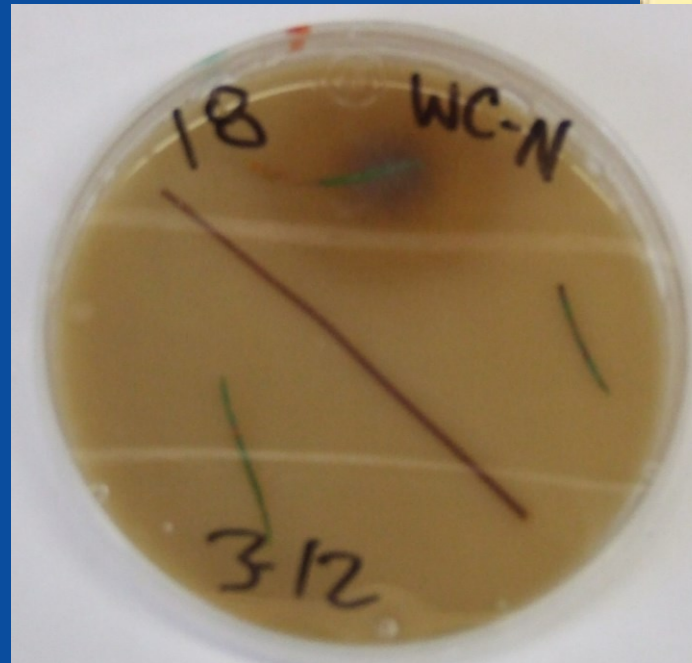
- ▶ Work from symptoms to signs. Contact your area forest health specialist.
- ▶ Do you see evidence of insect damage?
- ▶ Are only previous years' needles affected or only current year's, or both?
- ▶ Is there shoot dieback too & not just needles?
- ▶ What's the pattern of necrotic tissue on foliage?
- ▶ Any fungal fruiting bodies in necrotic / killed tissue?





# Diagnosing foliage & shoot diseases

- ▶ Can require extra steps & be difficult at times & may require lab confirmation.
- ▶ Work with your area forest health specialist.





# Rhabdocline needle cast

caused by *Rhabdocline pseudotsugae* & *R. weirii*



- ▶ Host: Douglas-fir, occurs throughout the range of DF
- ▶ Causes red spots on infected needles, then needles killed and shed early
- ▶ Infection often occurs in May or June. Symptoms develop in fall or the following spring after infection.
- ▶ When severe, could cause growth loss, especially in younger trees and plantations



(Photos: Andrej Kunca)



# Rhabdocline needle cast



Fruiting bodies (apothecia) of the fungal pathogen on the underside of needles

(Photo: Petr Kapitola)



(Photo: USFS North & Intermountain Region)

- ▶ Other info - Chastagner, G. A. 2001. Susceptibility of intermountain Douglas-fir to Rhabdocline needle cast when grown in the Pacific Northwest. Online. Plant Health Progress



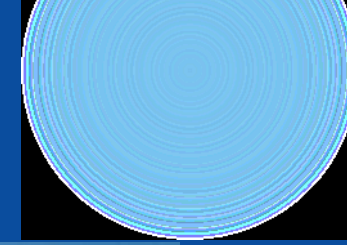


# Swiss needle cast

caused by *Phaeocryptopus gaeumannii*

- ▶ Host: Douglas-fir
- ▶ Causes chlorosis (yellowing of needles), thin crowns, poor needle retention
- ▶ Most severe in coastal Oregon areas where Douglas-fir has been planted in the hemlock and spruce zone. Also present in coastal WA, interior parts of North America.
- ▶ Results in significant growth loss in coastal areas, other areas but rarely causes mortality.

(Photo: Dave Shaw, OSU Swiss Needle Cast Cooperative)



Infection occurs in newly formed needles in spring

(Photo: OR Dep. of Forestry 2014 Annual Forest Health Report)





# Swiss needle cast

**Black fruiting bodies  
(pseudothecia) occupy  
stomata on underside of  
needles**



(Photos: OR Dep. Of Forestry)



(Photo: OSU Swiss Needle  
Cast Cooperative)

For more information, visit <http://sncc.forestry.oregonstate.edu>



# Others emerging on Douglas-fir

Research ongoing in Oregon related to:

▶ *Phytophthora pluvialis* →

▶ Web blight due to *Rhizoctonia* sp.



(Photo: OR Dep. of Forestry 2014 Annual Forest Health Report)



# Larch Needle Blight

Caused by  
*Hypodermella laricis*

- Killed needles are retained on branches
- Closely tied to spring precip., temperature and timing of budbreak
- New infections occur in newly forming needles in spring



(B.C. Ministry of Forests)



# Larch Needle Blight

Caused by  
*Hypodermella laricis*

- Killed needles are retained on branches



(Hagle, Gibson,  
and Tunnock 2003)

**Larch needle blight causes needles to droop on branches turning red the first year and gray after that. Black dots of fruiting bodies (hysterothecia) form in midsummer on needles.**

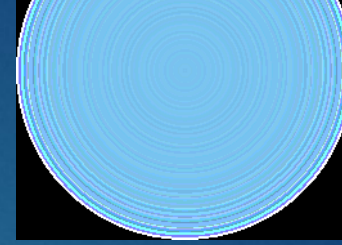


# Larch Needle Blight / Cast

Caused by  
*Hypodermella laricis*



(Photo: USFS, Northern & Intermountain Region)



Epidemics or outbreaks of larch needle diseases (due to this and *Meria laricis*) in the Interior Northwest have been reported roughly every 10 years.





# Larch Needle Cast / Blight

Caused by *Meria laricis*

Needles drop early.

Larch needle cast causes yellow spots which become red-brown.

Infections occur while needles are emerging in spring, and can continue to re-infect as long as rainfall creates suitable conditions.



(USFS, Ken Gibson)



(Hagle, Gibson, and Tunnock 2003)



# Larch Needle Cast

Caused by *Meria laricis*

Trees can be severely defoliated after wet springs & summers.

Fungal pathogen can reproduce quickly in wetter summers and reinfect needles.

At first glance, larch needle diseases may be confused with damage by larch casebearer or sawfly.



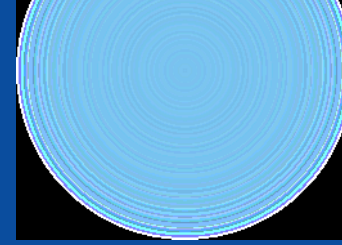
(Photo: OSU)



# Fir needle cast

caused by *Lirula abietis-concolor*

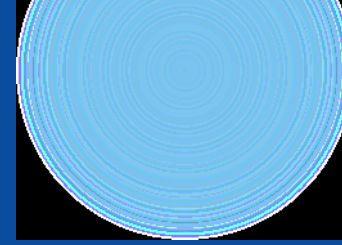
- ▶ Hosts: All true firs (*Abies* spp.)
- ▶ Not usually a management concern but may cause some growth loss in young trees
- ▶ Individual susceptibility varies (even within stands)
- ▶ Over time trees have thin crowns and dead lower branches





# Fir needle cast

caused by *Lirula abietis-concolor*



Black fruiting  
bodies  
appear as  
lines on  
underside of  
killed needles



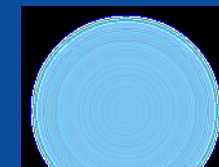
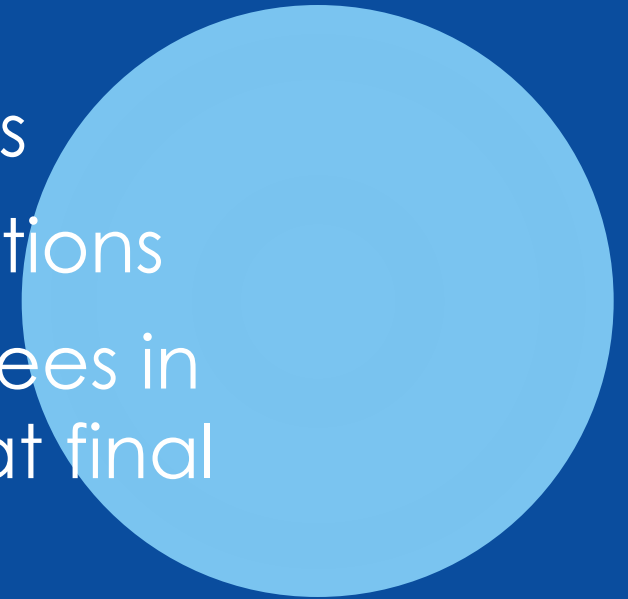
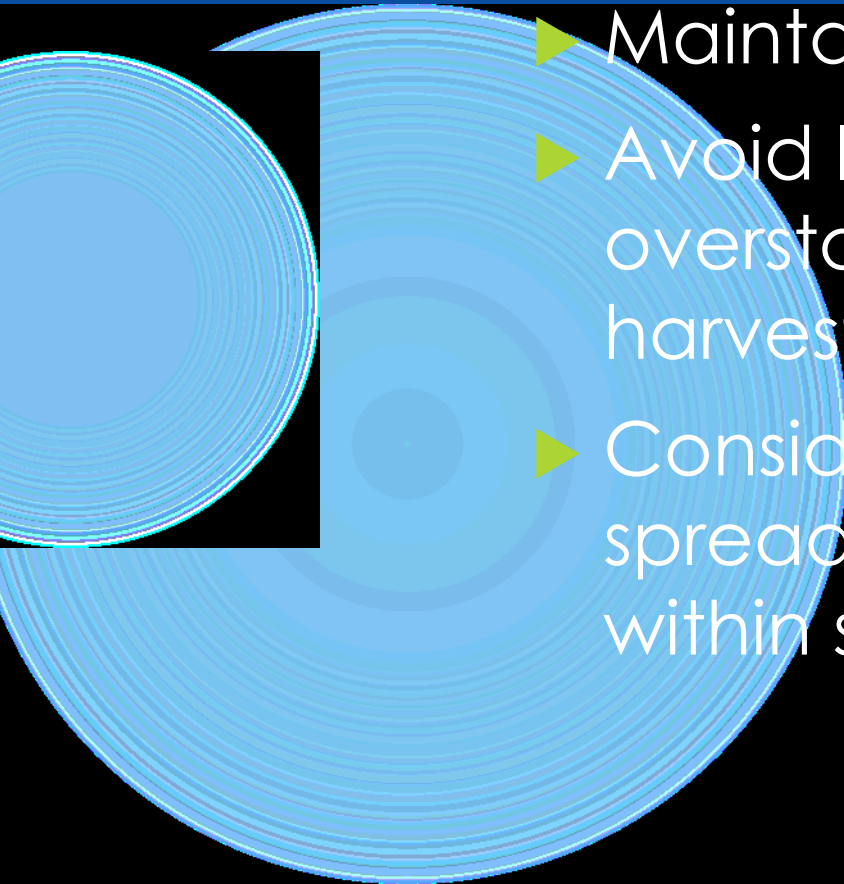
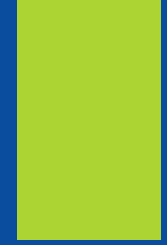
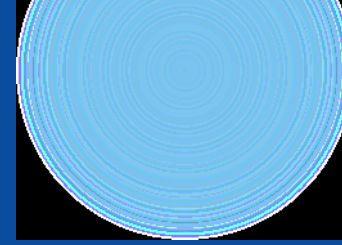
# Foliage diseases on pines

- ▶ Caused by similar groups of fungi & nearly all native
- ▶ Generally don't kill mature trees alone
- ▶ Can cause growth loss though & kill young trees
- ▶ Can threaten regeneration efforts
- ▶ Common in pure stands, young plantations & riparian areas
- ▶ Weather dependent so some years worse than others but symptoms typically arise one year after infection



# Management

- ▶ Do not plant off-site stock
- ▶ Plant mix of species in plantations
- ▶ Maintain open spacing in plantations
- ▶ Avoid leaving heavily-infected trees in overstory during thinnings and at final harvest
- ▶ Consider overstory to understory spread from adjacent stands, not just within stands





# Examples of common foliage and shoot diseases

- ▶ Lophodermella needle blight
- ▶ Lophodermium needle cast
- ▶ Dothistroma / red band needle blight
- ▶ Elytroderma needle cast
- ▶ Diplodia shoot blight

Some we can ID in the field, others require a closer look at fruiting bodies under the microscope, etc.





# Lophodermella needle blight on lodgepole pine

caused by *L. concolor* and other species



(Photo: USFS, Northern & Intermountain Region)



(Photos: Natural Resources Canada)





# Lophodermella / Bynum's blight on ponderosa pine

caused by *L. morbida* and other species

- ▶ More severe west of the Cascade Crest where ponderosa pine has been planted in the Douglas-fir zone
- ▶ Can cause significant growth loss and threaten regeneration
- ▶ Light to dark brown fruiting bodies of *L. morbida* occur in a row on needles



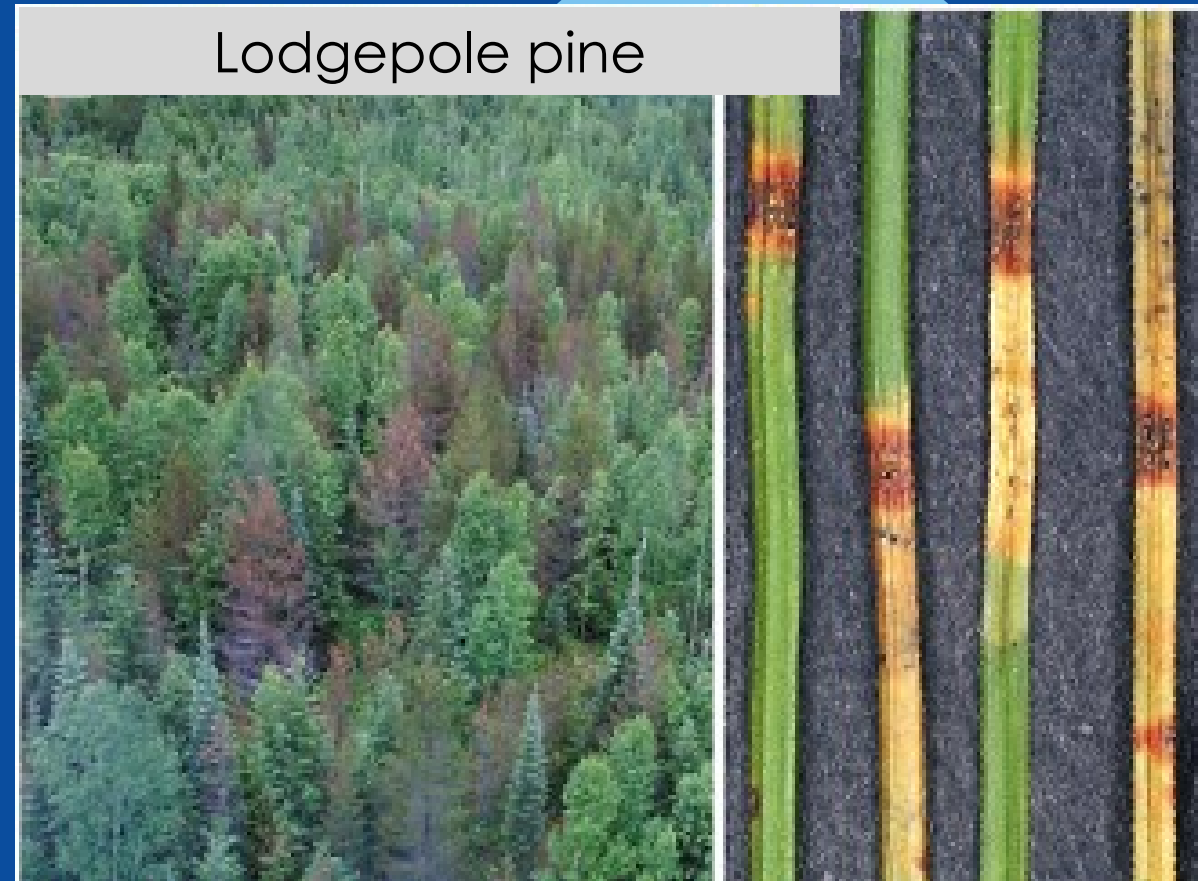
(Photo: OSU)



# Dothistroma / red band needle blight

caused by *Dothistroma septosporum* & *D. pini* (tel. *Mycosphaerella*)

- ▶ Hosts: **lodgepole**, ponderosa, western white (+ many other pines)
- ▶ Common symptom: Red banding on needles, at times base of needles may remain green
- ▶ Trees infected over several years can have “bottle brush” symptoms
- ▶ Often more severe in young trees with crowns low to the ground, but can be severe in mature trees
- ▶ Locally severe at times but trees typically are not killed



(Pierre de Witt et al. 2012, PLOS genetics, Vol 8, Issue 11, pg 3)



## Dothistroma / red band

- Rapid disease development after warm wet periods
- Conidiospores released when wet &  $>45^{\circ}\text{F}$
- Ideal conditions for new infections are when temps  $59\text{-}68^{\circ}\text{F}$

(Alex Woods)





# Potential effects of a warming climate on foliage diseases: Example of Dothistroma / red band needle blight epidemic in British Columbia

- Past planting increased abundance of pure lodgepole pine stands
- Recent increase in summer precip.
- Warmer overnight minimum temperatures & more warm, wet days in spring/summer
  - =Exceptional conditions for certain fungi that cause foliage diseases
- Repeated defoliation is causing mortality



(Alex Woods)



(2006 Harry Kope)





# Elytroderma needle cast / blight

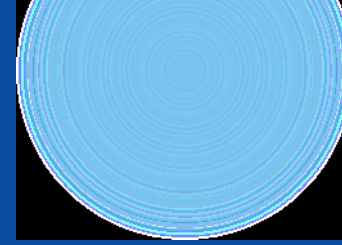
caused by *Elytroderma deformans*

- ▶ Hosts: **ponderosa** and lodgepole
- ▶ Common & most damaging around wet meadows, lakes, near riparian areas, cold air drainages
- ▶ Causes branch flagging and curled branch tips, brooms
- ▶ Can have significant impacts on regeneration and be locally severe at times





# Elytroderma needle cast



Fungal pathogen can enter branches and induce brooms

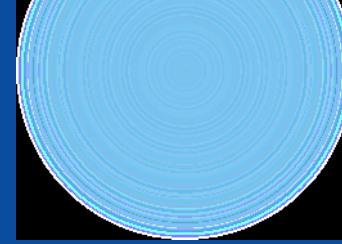


(Mike Schomaker)

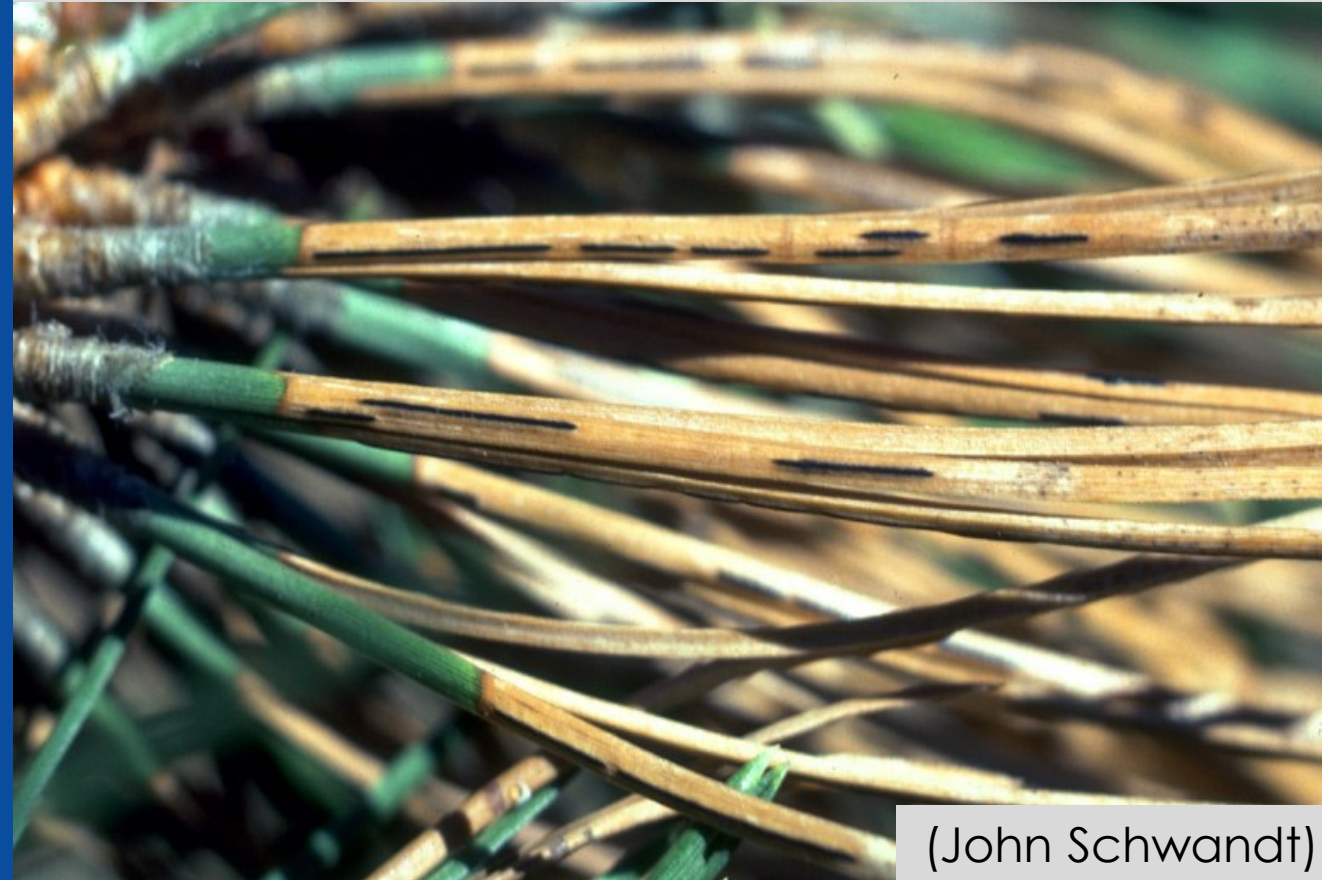
(John Schwandt)



# Elytroderma needle cast



Fruiting bodies (hysterothecia) of *E. deformans* are diagnostic on needles



(John Schwandt)





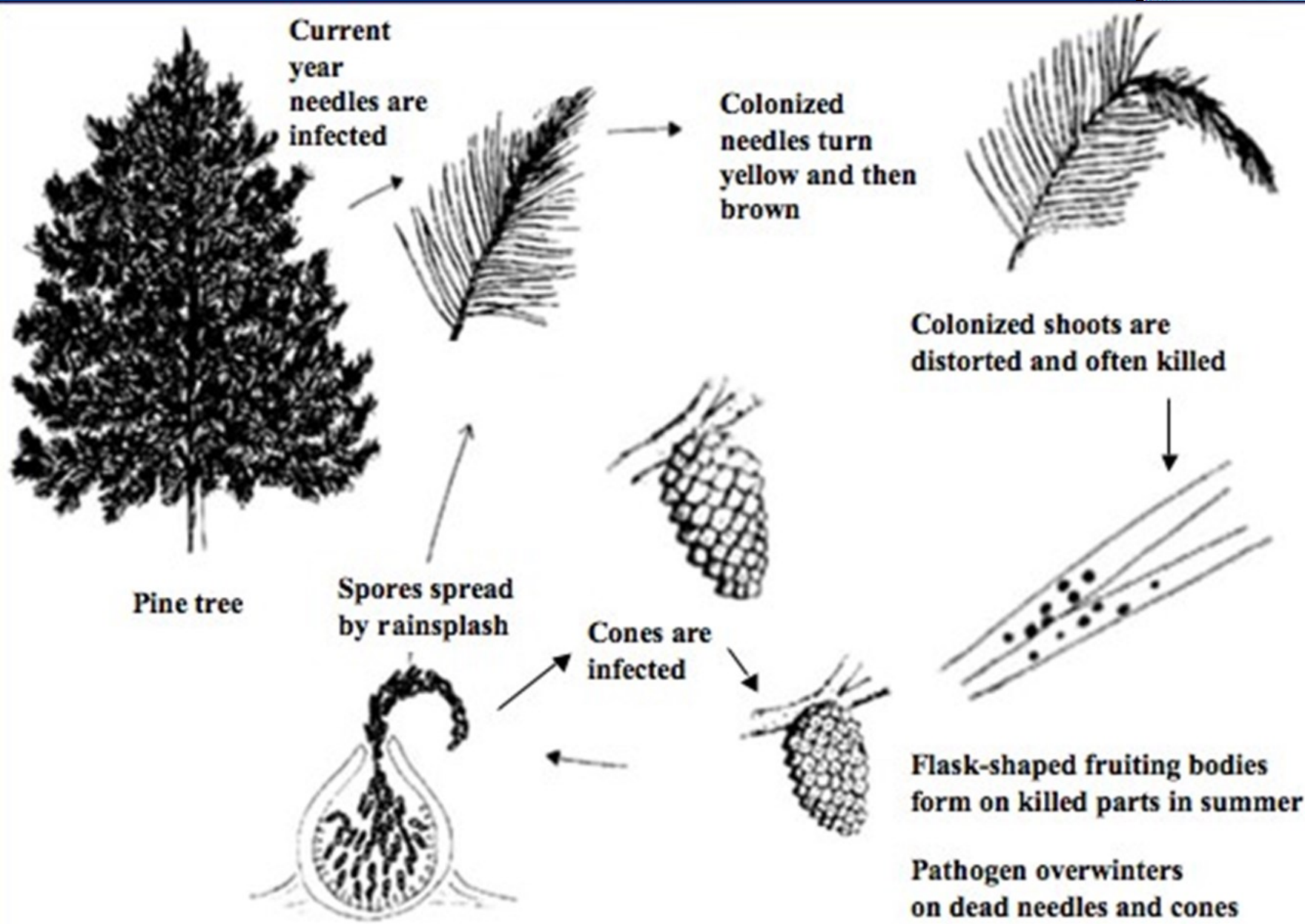
# Diplodia shoot blight caused by *Diplodia pinea*

- ▶ Hosts: **ponderosa** and lodgepole (+ many other 2- or 3-needle pines)
- ▶ Causes dieback, kills needles and stems of shoots causing “shoot or tip” blight. Sometimes “shepherd’s crook” symptoms
- ▶ Often more of a problem in plantations and off-site plantings
- ▶ Drought can result in more severe shoot blight
- ▶ When severe, can predispose trees to damage by other agents and mortality in some cases





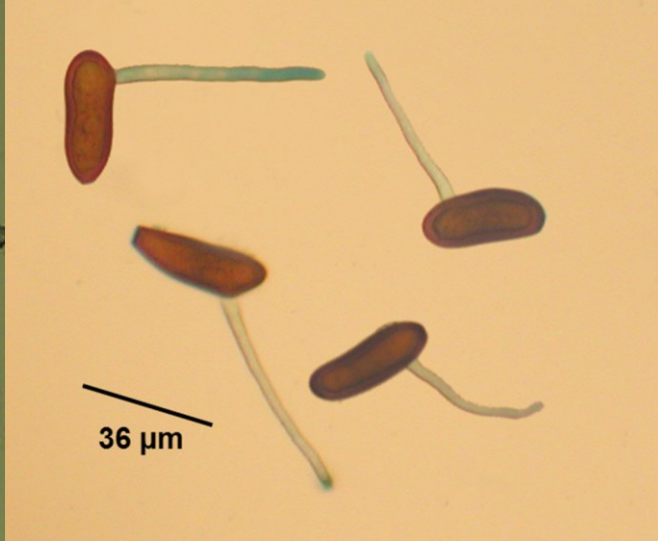
# Diplodia shoot blight disease cycle





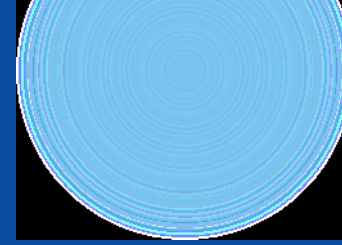
# Diplodia shoot blight

Black fruiting bodies (pycnidia) form on dead host material like twigs, needles and cones bearing spores (conidia)





# Questions?



*Lophodermella* sp. on  
lodgepole pine



# Recap of considerations for foliage diseases

- ▶ Monitor situation, typically not tree killers by themselves. Things may improve after a year or two and often not a huge management concern.
- ▶ Contact your area forest health specialist to confirm diagnosis and for more info.
- ▶ Use local seed sources and plant appropriate species on-site.
- ▶ Enhance diversity when possible. The most damage can be expected in pure, dense stands.
- ▶ Thin in plantations for open spacing to avoid environmental conditions that favor fungal pathogens. If you have funding and time, could prune lower branches (up to 50% of total height).
- ▶ Remove heavily-infected trees during thinnings and at final harvest.
- ▶ Consider whether trees in adjacent or nearby stands will be a source of inoculum.