

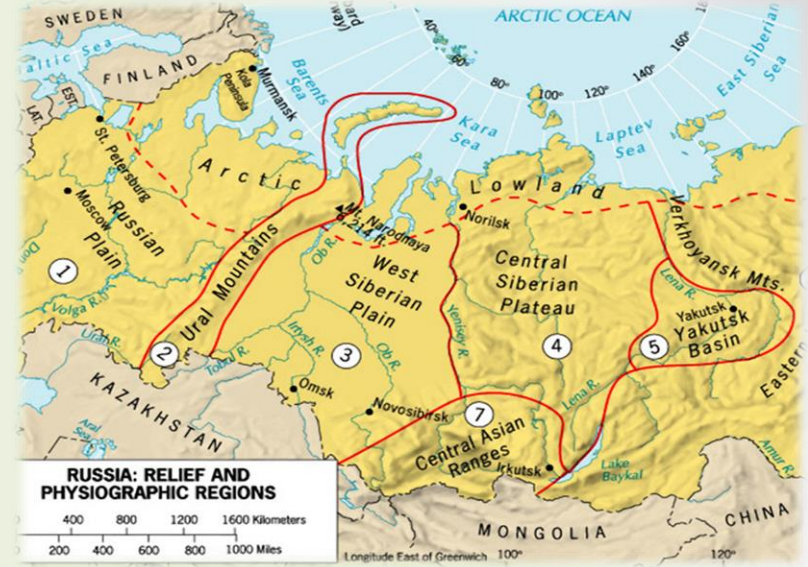
# The History and Future of White Pine Blister Rust in North America



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# Pathogen: *Cronartium ribicola* (NON-NATIVE, INVASIVE)



Hosts: 5-needle pines, currants & gooseberries, scarlet paintbrush, lousewort



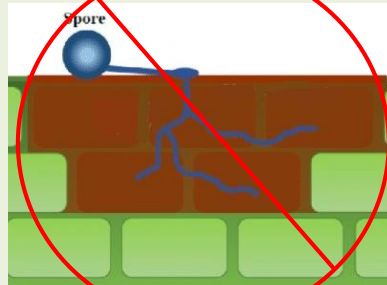
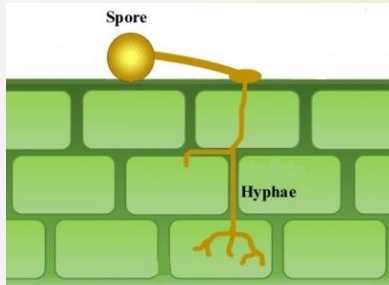
# *Cronartium ribicola*

Rust fungus

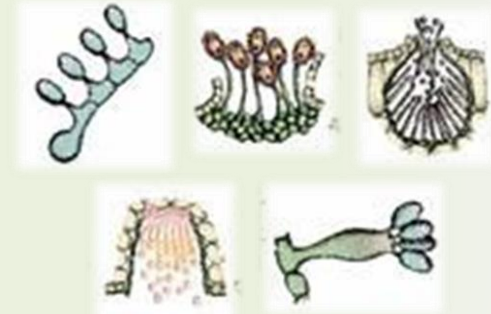
Obligate Parasite

Biotroph – feed on live cells

Macrocytic – 5 spore stages

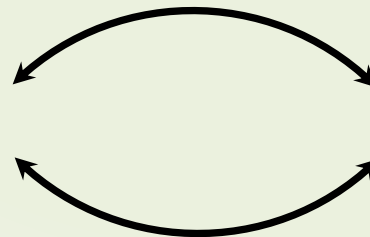


Pawlowski & Hartman. 2016. In: Fungal Pathogenicity DOI: 10.5772/62305



tajtjr.blogspot.com/2012/06/fitopatologia-i-hongos.html

Heteroecious – 2 hosts to complete lifecycle



## Principal Hosts

eastern & western white pine

sugar pine

limber pine

whitebark pine

Great Basin & Rocky Mt. bristlecone pine

foxtail pine

southwestern white pine

## Alternate Hosts



*Ribes*: gooseberry, currant



*Castilleja*:  
scarlet paintbrush



*Pedicularis*:  
lousewort

# Spindle-shaped swelling



Search: Männi-koorepõletik



**Ruptured Bark**



**Top Kill**



Photo: Ontario.ca

**Resinosis**



**Branch Kill**



Anna Schoettle

**Rodent Gnawing**



Maine Forest Service

**Girdling**

## *Ribes*

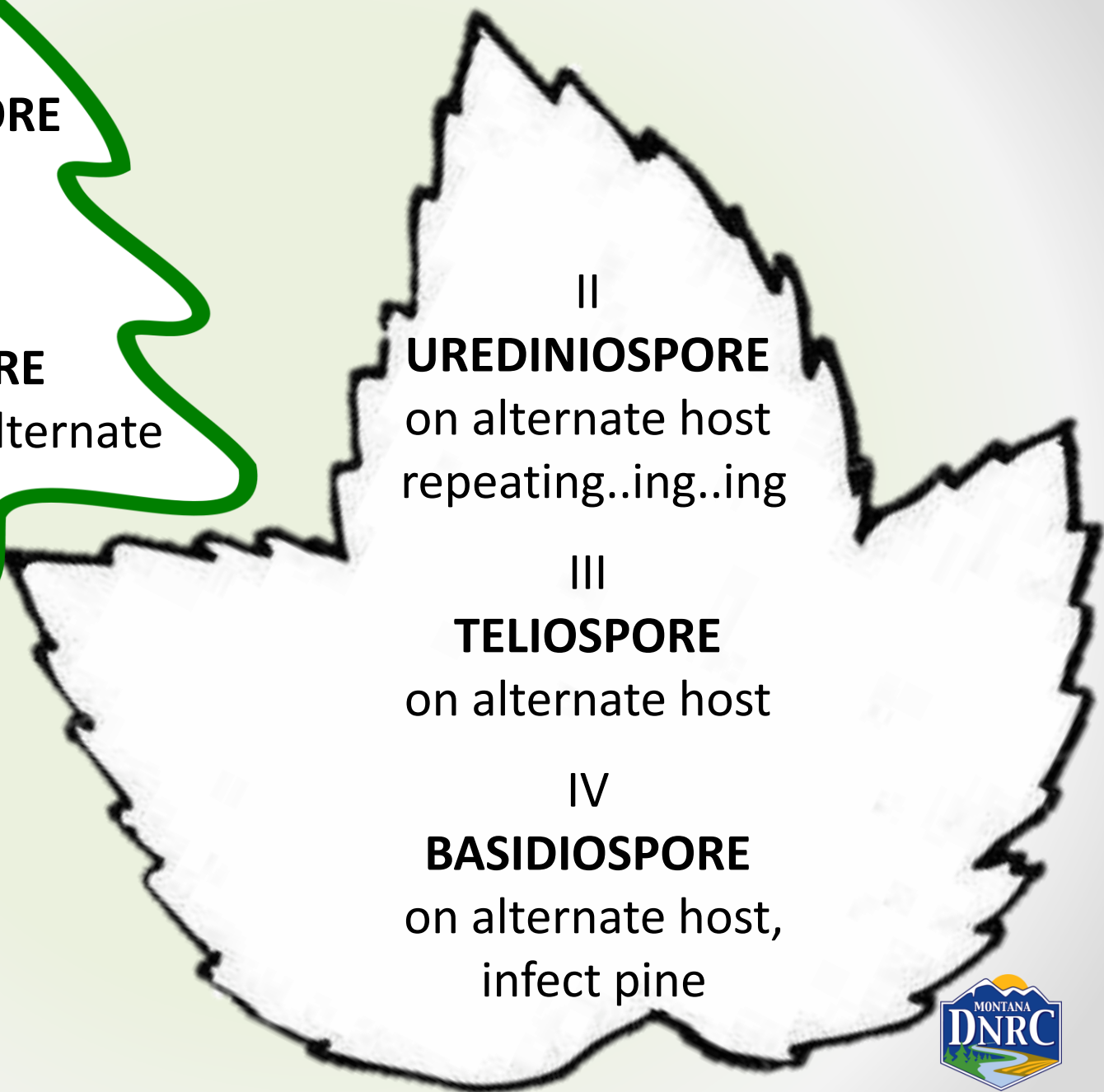
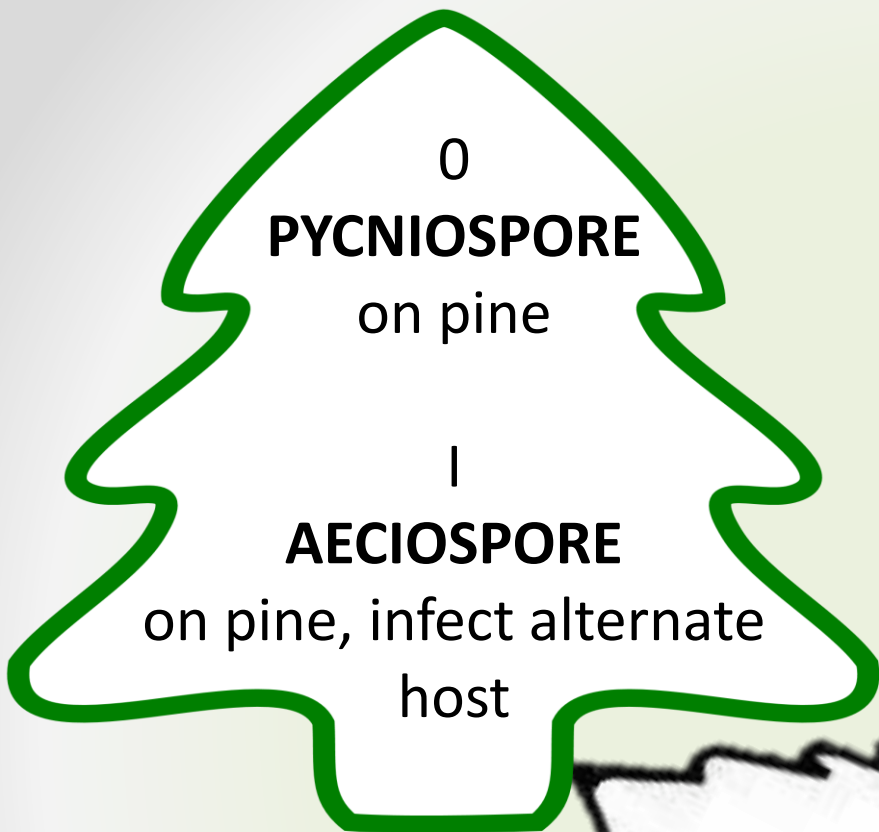


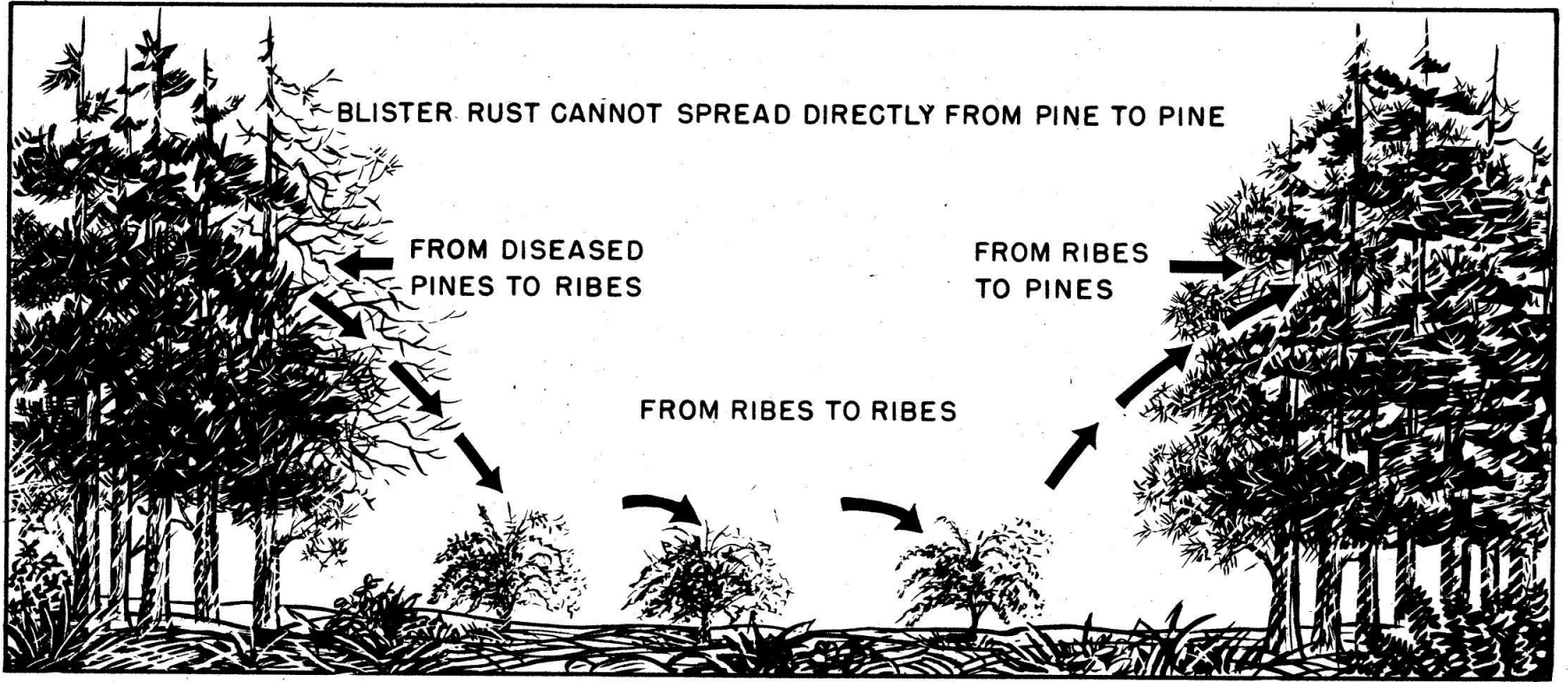
## *Castilleja*



## *Pedicularis*











Fungus grows through twigs to branches and stem



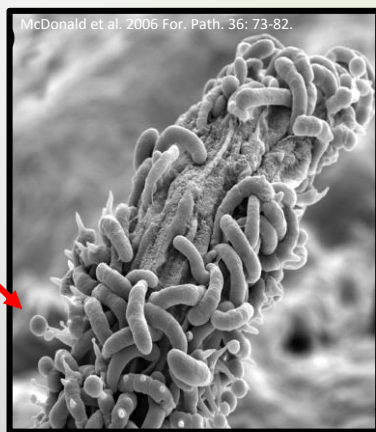
**(B)**  
**Pycniospores** are produced in ooze at canker margins



**(A)**  
**Basidiospores** produced on alternate host infect pine needles



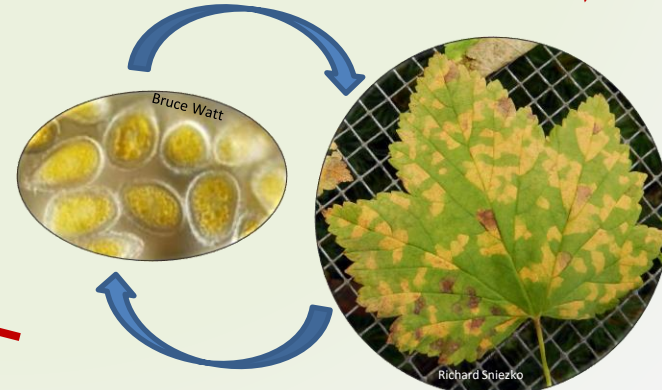
**(C)**  
**Aeciospores** erupt through bark to infect alternate host



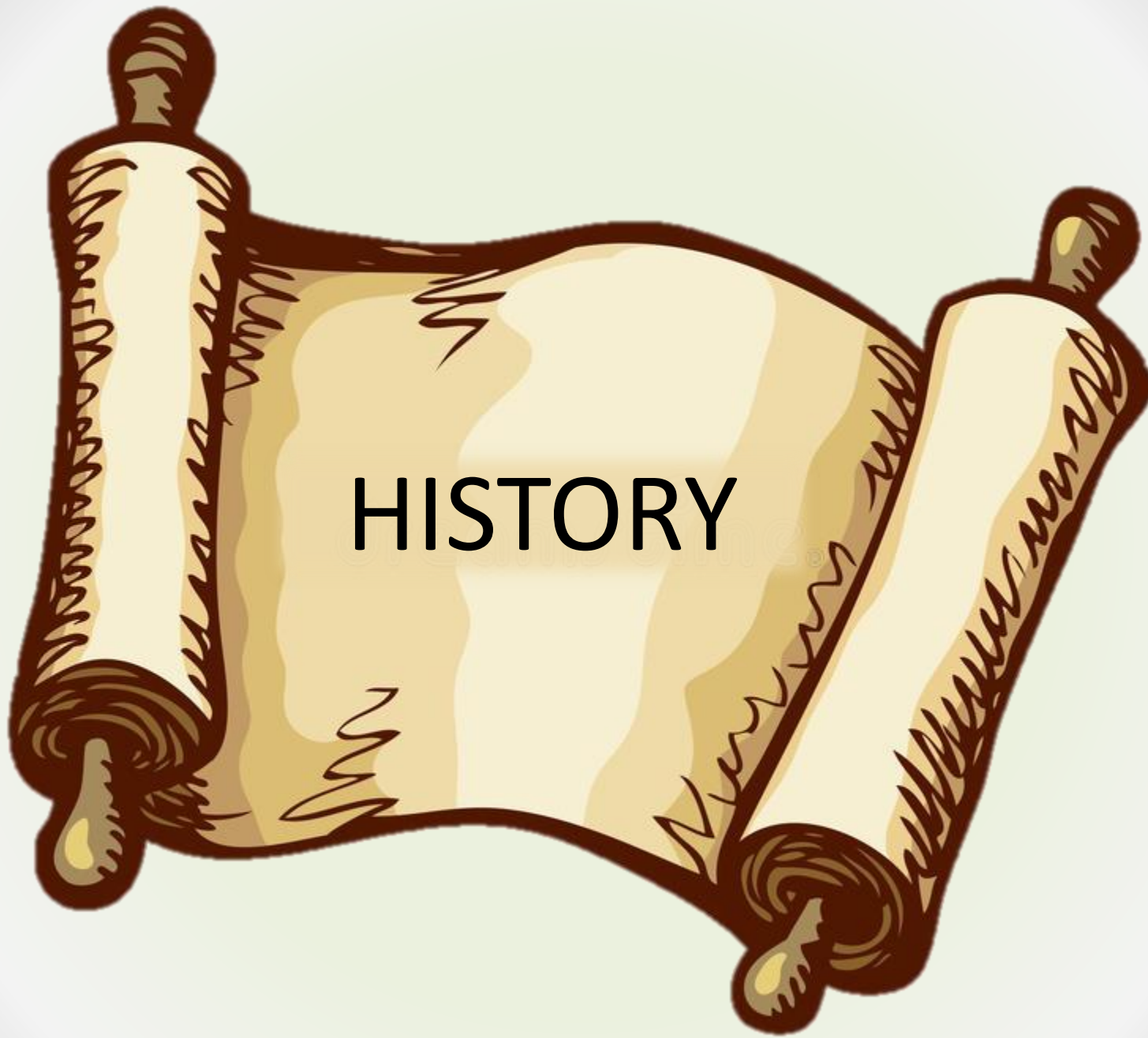
**(E)**  
**Teliospores** bear basidiospores to start cycle anew



**Teliospores** bear basidiospores to start cycle anew



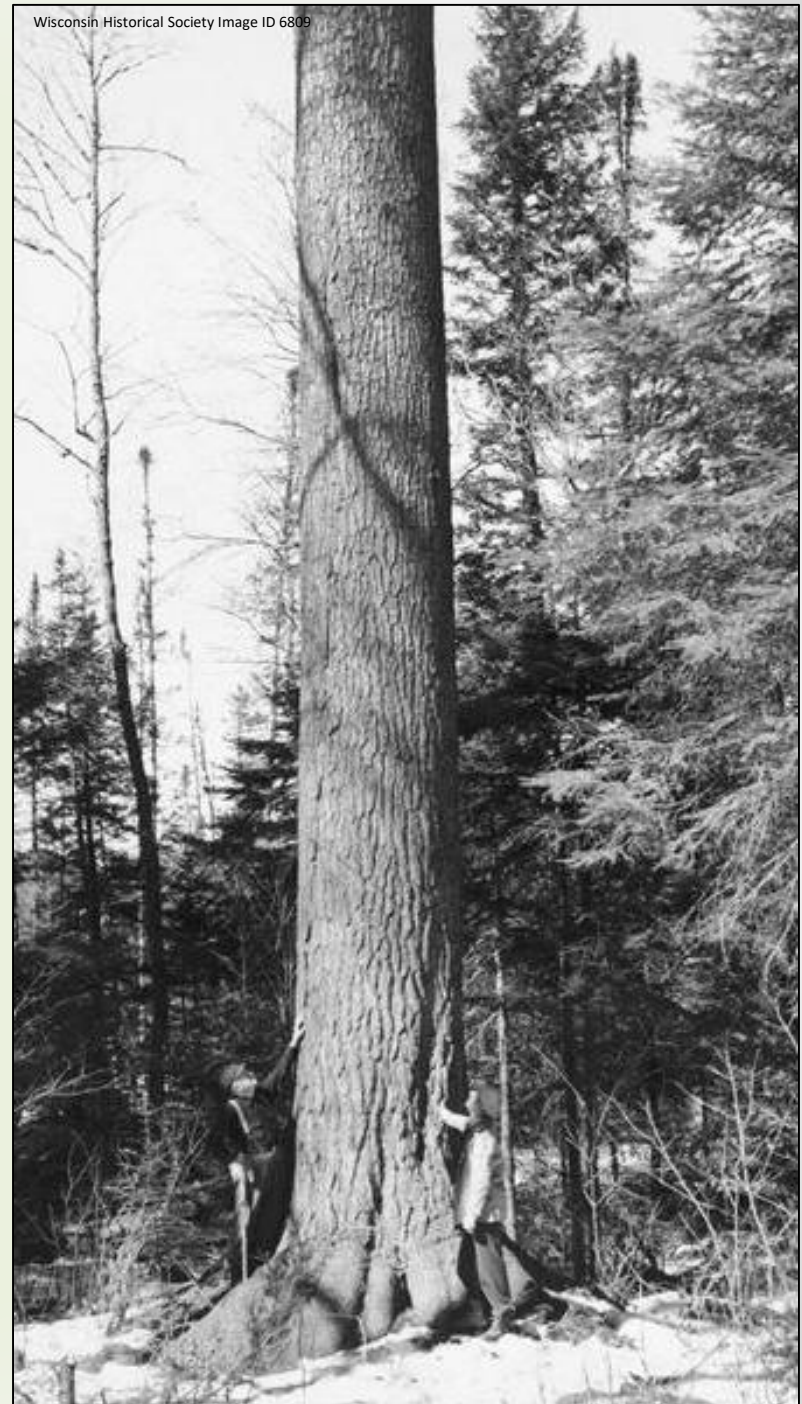
**(D)**  
**Urediniospores** repeatedly infect alternate host and give rise to telia



# HISTORY



Wisconsin Historical Society Image ID 6809



Import of infected *Ribes* to Europe  
Import of healthy white pine to Europe  
...blister rust develops in Europe!



U.S. population growth depletes white pine

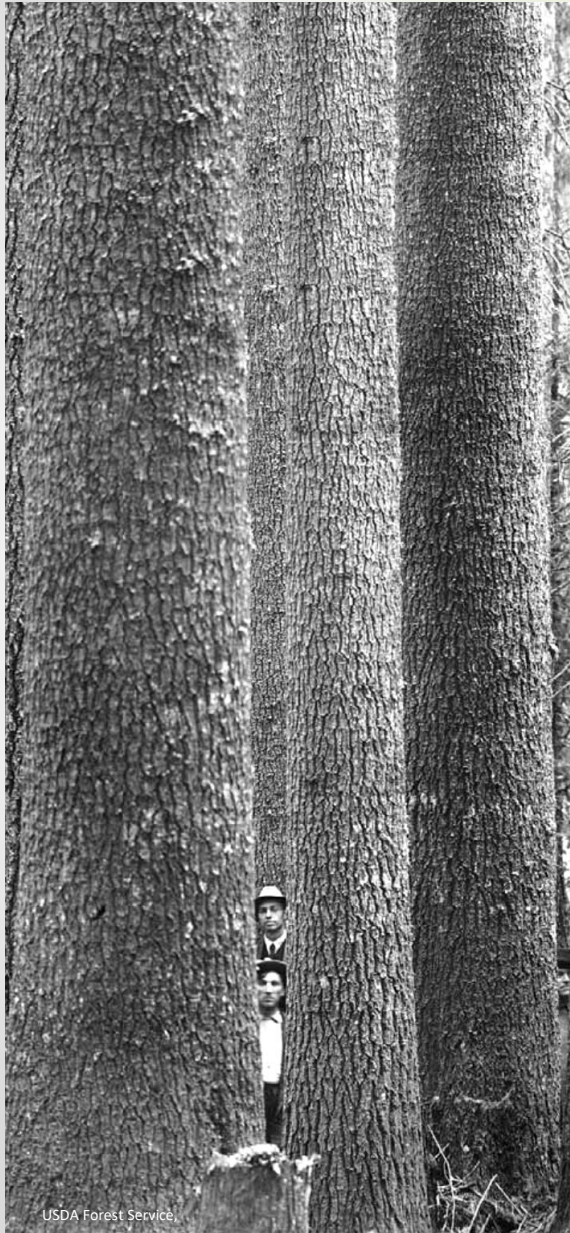
U.S. tree nurseries not growing white pine

U.S. imports white pine from Europe

...blister rust develops in the U.S.!



# Consequences: Timber Resources



USDA Forest Service



Central Sierra Environmental Resource Center CSERC



Quality Logs (Top Cut,) Scale 16,170 Feet, Cut From Largest Known  
White Pine Tree by Potlatch Lumber Company, Potlatch, Idaho

G.B. Joslin, courtesy of Potlatch Corporation

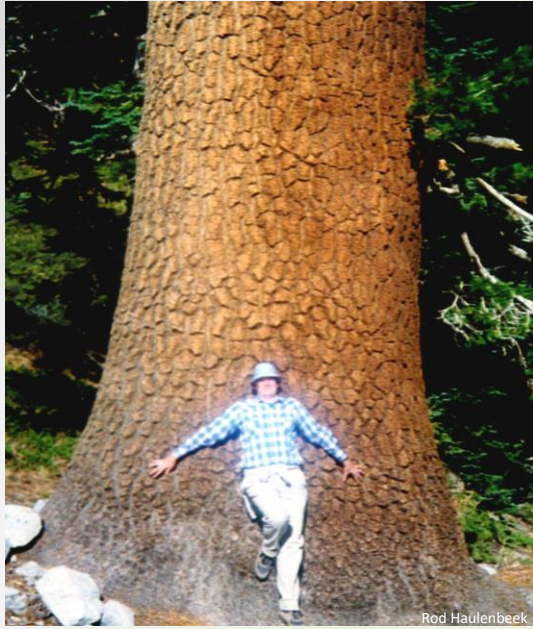
G.B. Joslin, courtesy of Potlatch Corporation



Lumber Sawn From the White Pine King, by Potlatch  
Lumber Company, Potlatch, Idaho

According to act of Congress, 1912, by G. B. Joslin

**western white pine**



**sugar pine**



**western white pine**



**sugar pine**



**sugar pine**



**eastern white pine**



# Consequences: Ecosystem Resources



**snow & soil retention**

**tree islands**



**food & shelter**



Sarah Jane Keller



NPS

# non-native fungus



+

# mountain pine beetle



Inadequate natural resistance to fungus

Cone-bearing branches killed

Regeneration killed

Pine beetle outbreaks hasten death





So what has been done, what can we do now, and what is the future?



# What has been done: Regulation & Eradication 1909 - 1967



Museum of North Idaho

- 1912 **Plant Quarantine Act** prohibits pine & *Ribes* imports
- 1915 USDA Bureau of Plant Industry creates **Office of Blister Rust Control (OBRC)**
- 1917 – 1968 Mass effort for ***Ribes* eradication**. Full time, seasonal, and CCC crews

# What we are doing now: Pruning, Planting, Monitoring



# Now and the Future: Breeding for Resistance



# Now and the Future: Breeding for Resistance



Photos: Richard Sniezko, USDA Forest Service Dorena Genetic Resource Center



Southern Rockies Rust Resistance Trial (SRRRT)



**Resistance = Genetics + Environment**

Losses still occur with resistant seedlings!



Photos: Richard Snieszko, USDA Forest Service Dorena Genetic Resource Center



# Directions for the Future

- Expanding programs with whitebark, bristlecone, limber
- Crosses with Eurasian white pines
- Combining expressions of resistance
- Large-scale operational planting







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