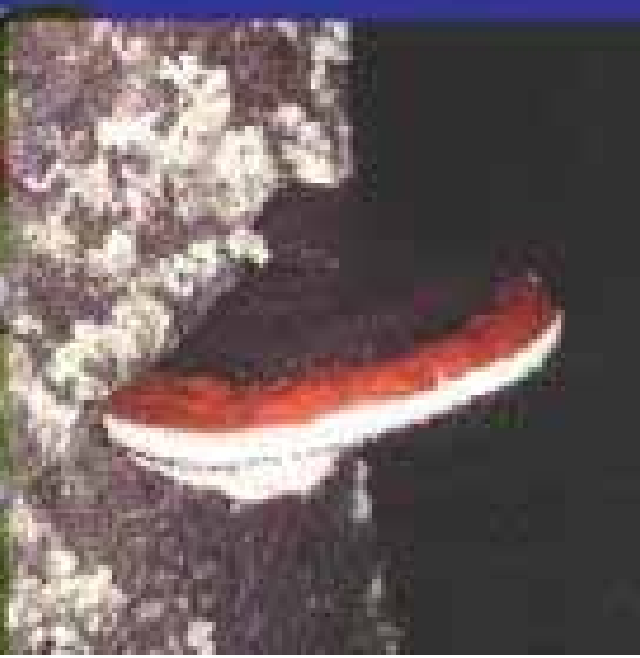
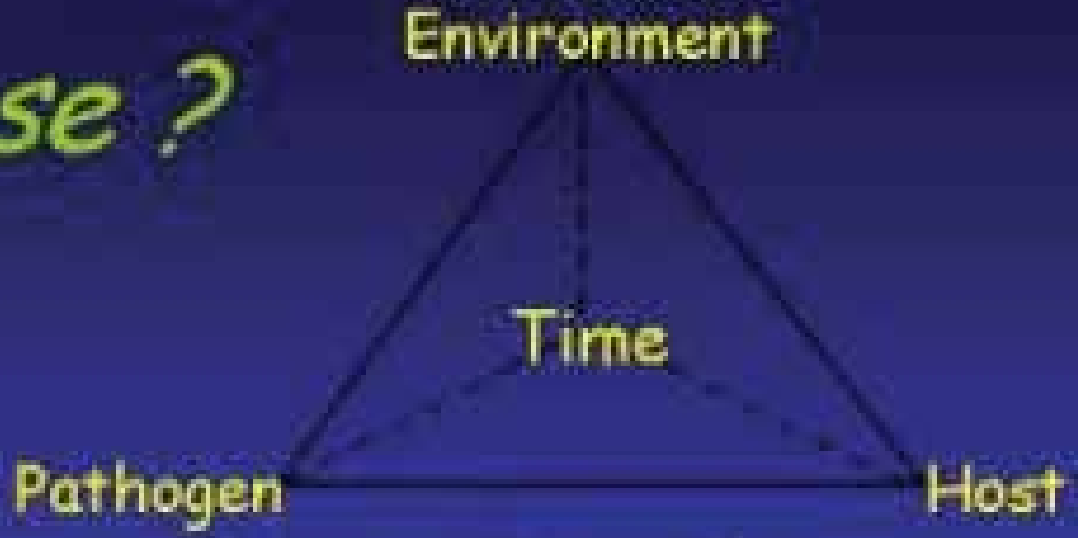
Forest Diseases

Holly Kearns, USDA Forest Service



What is a Disease ?



An interaction between a host, a pathogen, and the environment that results in some sort of malfunctioning of the host

What causes disease?

- Fungi
- Parasitic plants
- Bacteria/Viruses
- Nematodes

Roles of Forest Diseases

- Most diseases are native.
- A main driver of forest succession, structure, and composition.
- "Outbreak" = response to forest conditions, host availability, and environmental conditions.
- The best way to deal with most diseases is to prevent them through sound management.

Types of Diseases

Diseases are often grouped by part of tree attacked

- Root diseases
- Stem/Branch diseases
  - Cankers
  - Dwarf mistletoes
  - Decays
- Foliage diseases

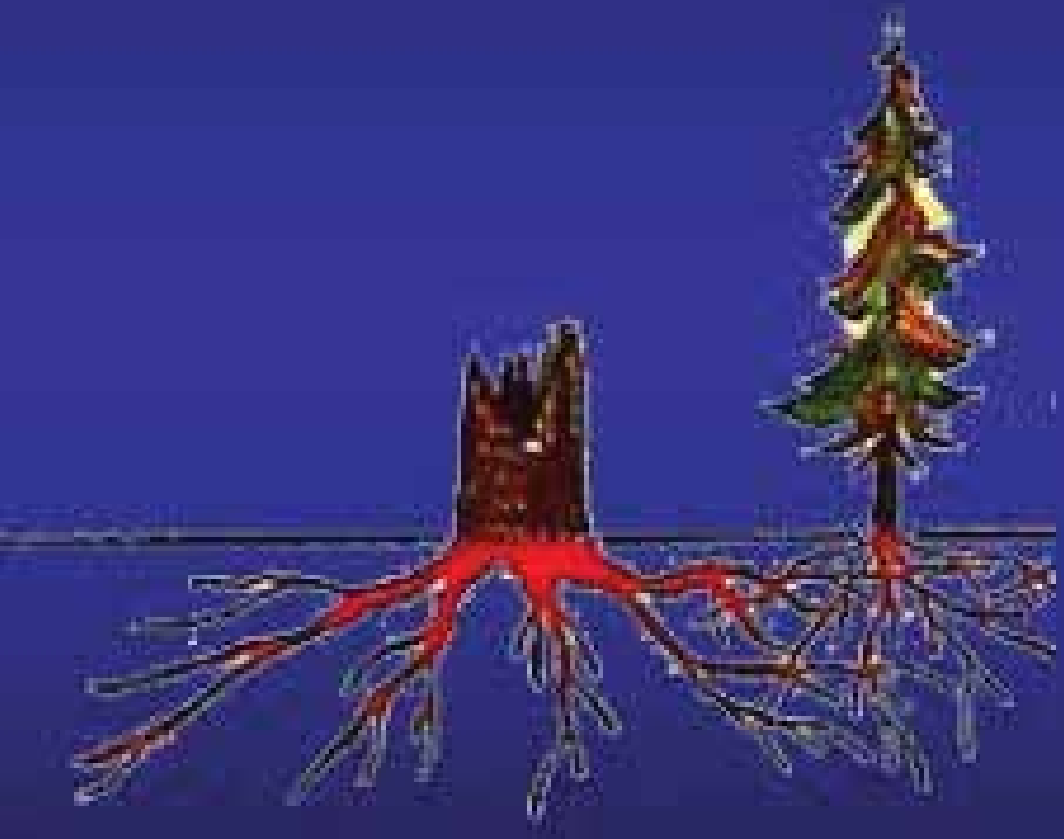
Root Diseases

- Caused by fungi that live underground
  - Usually the oldest organisms in the forest - often thousands of years old
- Attack and kill tree roots
  - Limiting water and nutrient uptake
- Cause decay in roots and butt
  - Weaken trees
  - Cause windthrow & breakage
- Difficult to manage
- Extremely widespread


Root Diseases
North Idaho: 2 million acres
Montana: 1.4 million acres


Tree species most susceptible:
Douglas-fir
Grand fir
Subalpine fir
Tree species most tolerant:
Western larch
Pines

Primary spread

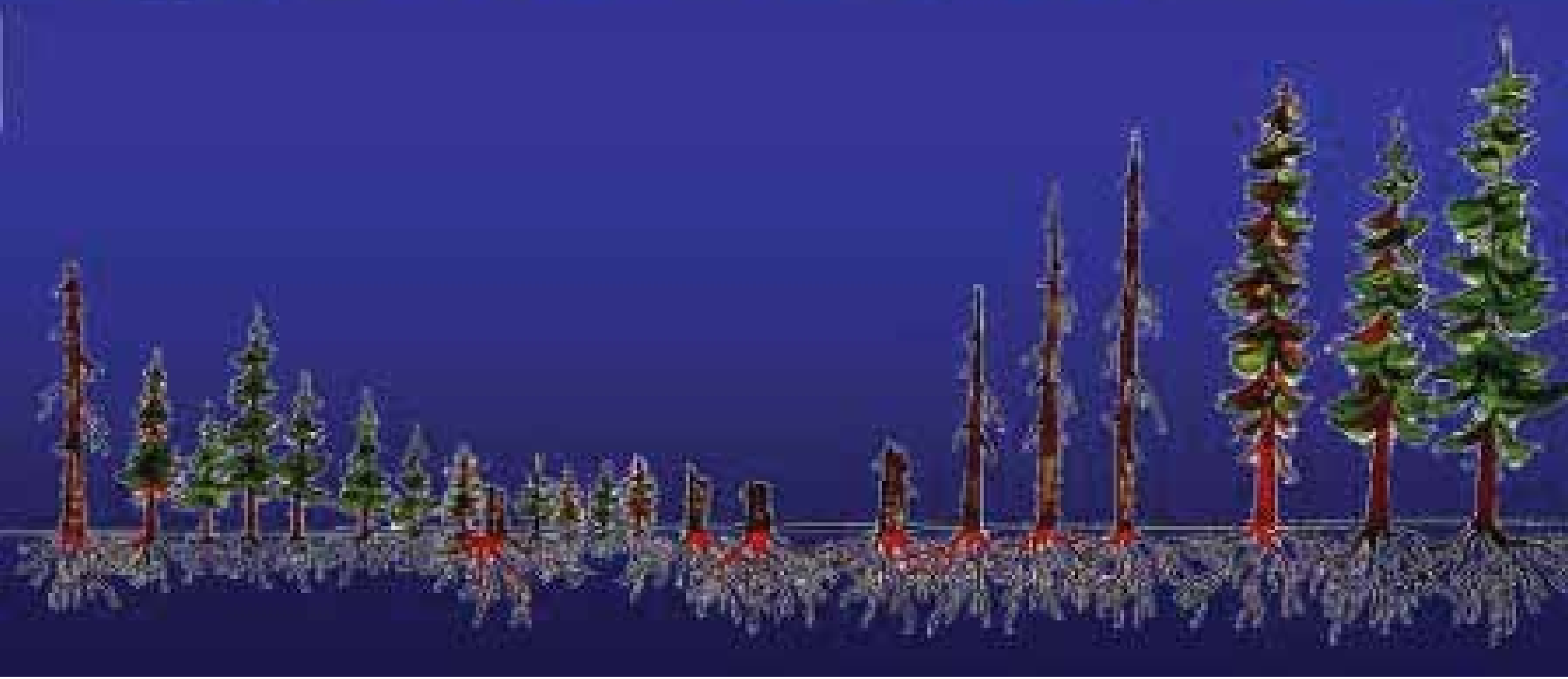


- After a fire or harvest, the fungus will live in dead roots until a new generation of trees is available.
- All conifers are susceptible to this type of infection when they are very young (up to about 20 yrs. old).

Primary spread - stump to tree

Secondary spread from tree-to-tree

When tree root systems are large enough, the fungus can move tree-to-tree across roots.



Tree-to-tree spread throughout the life of the Douglas-fir, grand or subalpine fir stand

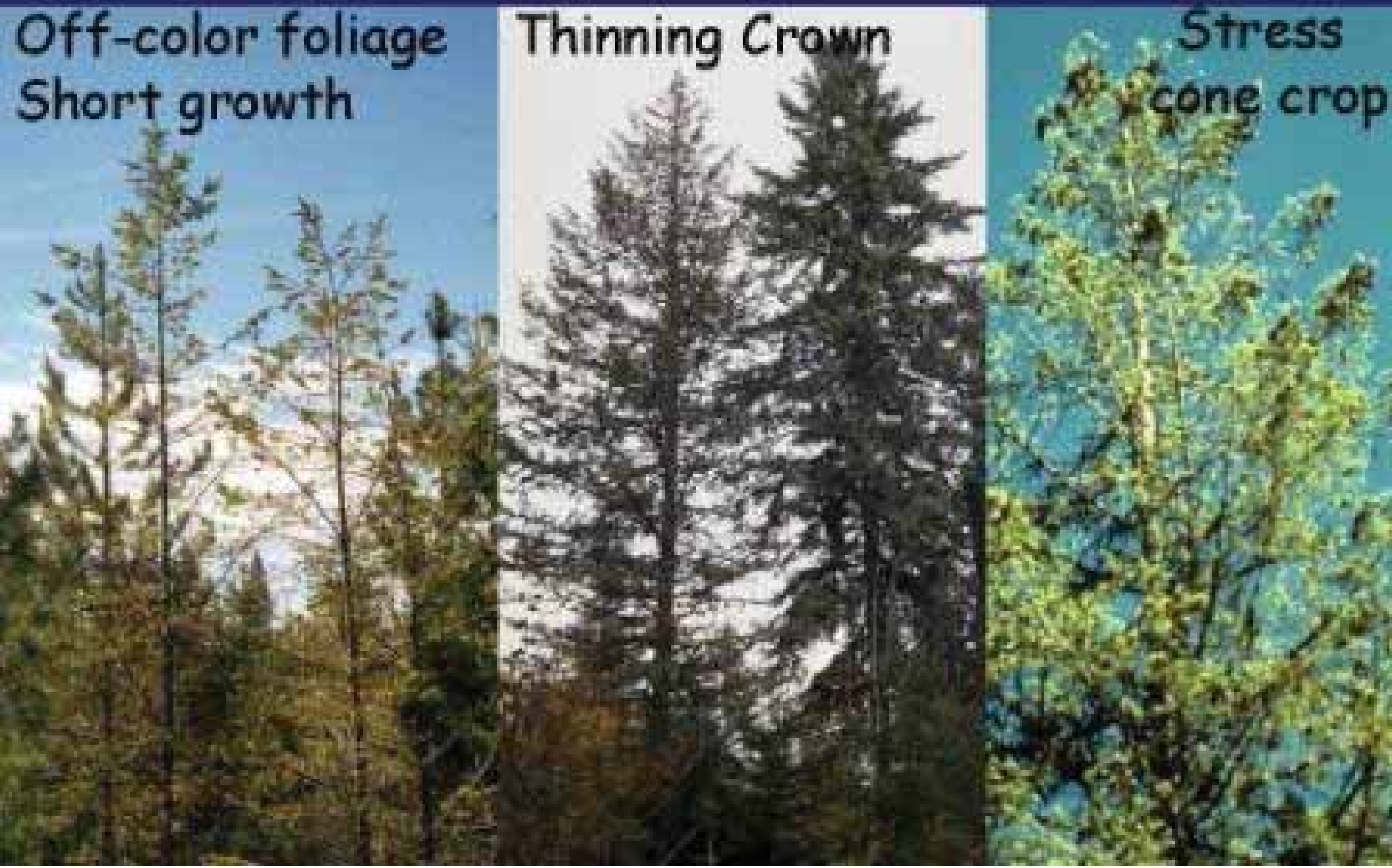
How do you know when you have it?

Characteristics of Stands with Root Diseases

- Trees in various stages of decline
  - Disease spreads from tree to tree via root contacts
  - Trees die over time - not all at once
- Susceptible species are affected; Tolerant species are less affected
- Dead/dying trees groups or scattered
- Root diseased trees often attacked by bark beetles

Root Disease Pattern of Mortality

Symptoms of Root Disease



Major Root Diseases

- Armillaria root disease
- Laminated root disease
- Annosus root disease

Armillaria Root Disease

- **Major Hosts:** Douglas-fir, grand fir, subalpine fir
- **Other Hosts:** Most other conifers

Generally, a rapid killer of trees of all ages.

Armillaria Root Disease

- Basal pitching common
- Mycelial (fungal) fans under bark

Armillaria Fans in Ponderosa Pine

Armillaria Root Disease

Laminated Root Disease of Douglas-fir and grand fir

- **Major Hosts:** Douglas-fir, grand fir
- **Minor Hosts:** subalpine fir, western hemlock

Laminated Root Disease

Cream and golden colored fungus on outside of root bark

Laminated Root Disease

Laminated and pitted decay

Laminated Root Disease

Setal hyphae associated with decay

Annosus Root Disease

Two important types in Idaho:

- **Pine-type hosts**: mostly ponderosa pine
  - Infects surface of freshly-cut pine stumps
- **Fir-type hosts**: Douglas-fir, grand fir, subalpine fir
  - Root to root spread similar to Armillaria
  - also causes butt root in western hemlock, Engelmann spruce, western white pine and western redcedar

Annosus Root Disease

Most diagnostic: the presence of conks in stumps

Annosus Root Disease

Early stage of decay = red-brown stain (Douglas-fir) or red-purple (firs)

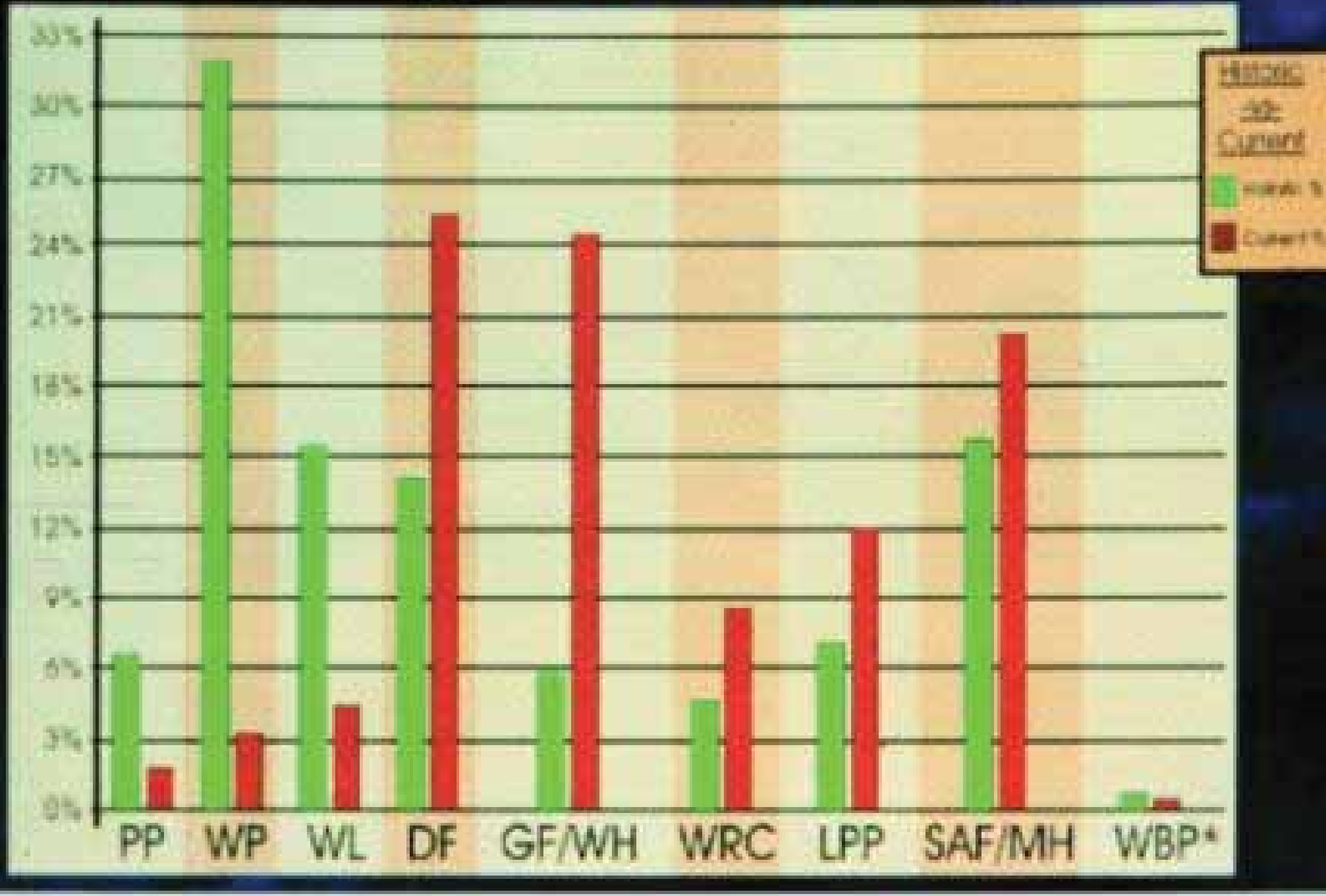
Annosus Root Disease

Advanced decay = irregular white pockets, black flecks, stringy & spongy

Root Disease Scenario

- Fire suppression allowed root disease susceptible species to dominate sites
- White pine blister rust removed western white pine
- Growth of western larch and pine slowed because of competition
- Selective logging removed root disease tolerant species (PP, WWP, larch)

IPNF Changes in Forest Composition



Root Disease Management

1. Monitor & identify:
   Root disease is sneaky!!
2. Favor tolerant species:
   Larch & pines!
3. Change species:
   If root disease is severe and tolerant species are not present in stand - Species Conversion.

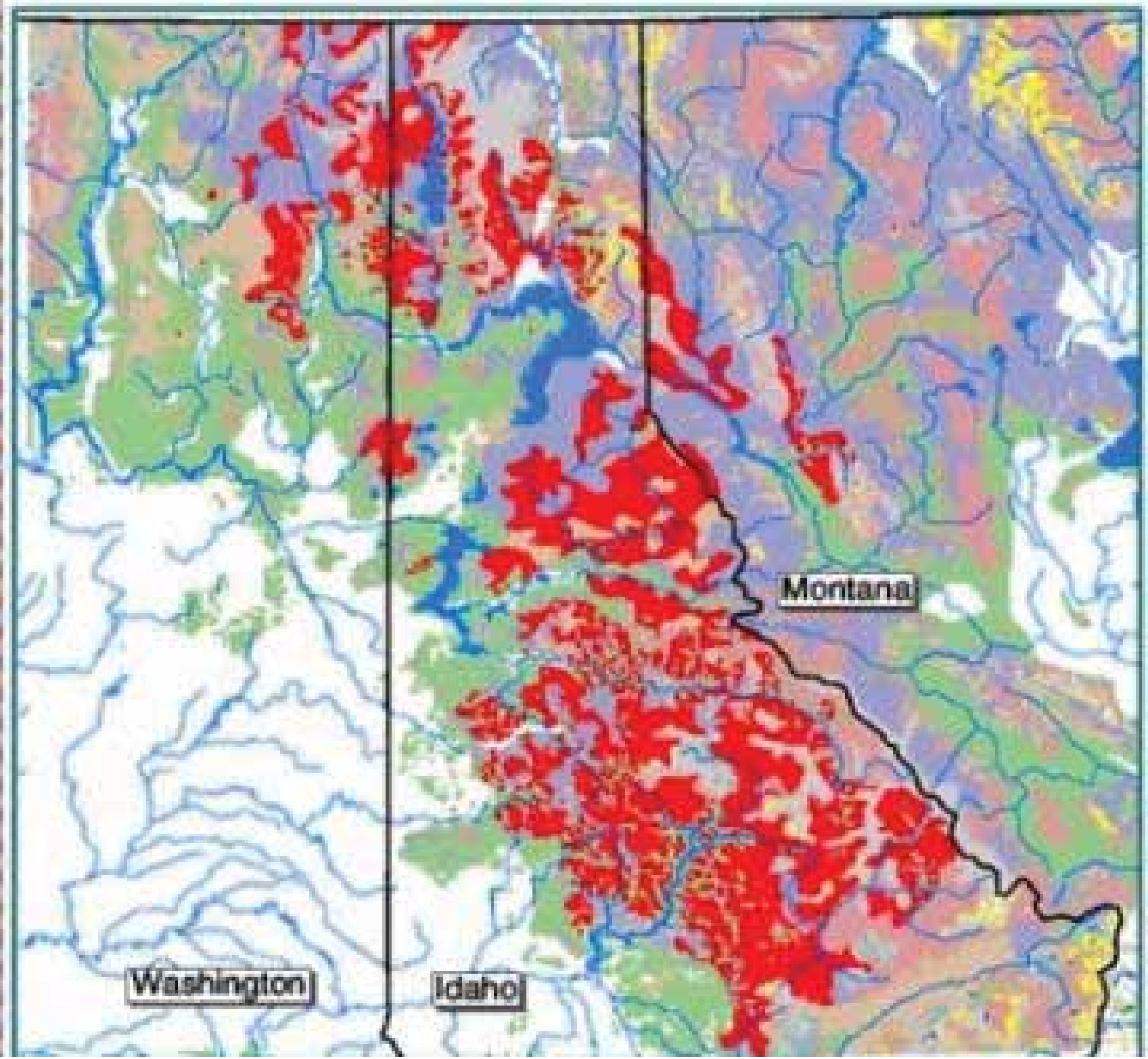
White Pine Blister Rust

History

- Exotic pathogen
  - Native to EurAsia
  - Imported 1910 from France
  - Arrived in Idaho via air currents ~1919

What is White Pine Blister Rust?

- A rust fungus (*Cronartium ribicola*)
- Complex life cycle
  - "Obligate Parasite"
  - 5 spore stages
  - Requires 2 hosts to complete life cycle
    - 5-needled pines
    - gooseberries/currants (*Ribes*)
  - Takes years to complete life cycle


Historic Cover Types
LEGEND
Major Rivers
State Border
Cover Types
Engelmann Spruce/ Subalpine Fir
Grand Fir/White Fir
Interior Douglas-fir
Int. Ponderosa Pine
Lodgepole Pine
Mt Hemlock
Water
Western Larch
Western Redcedar/ Western Hemlock
Western White Pine
Whitebark Pine
Montana
Washington
Idaho
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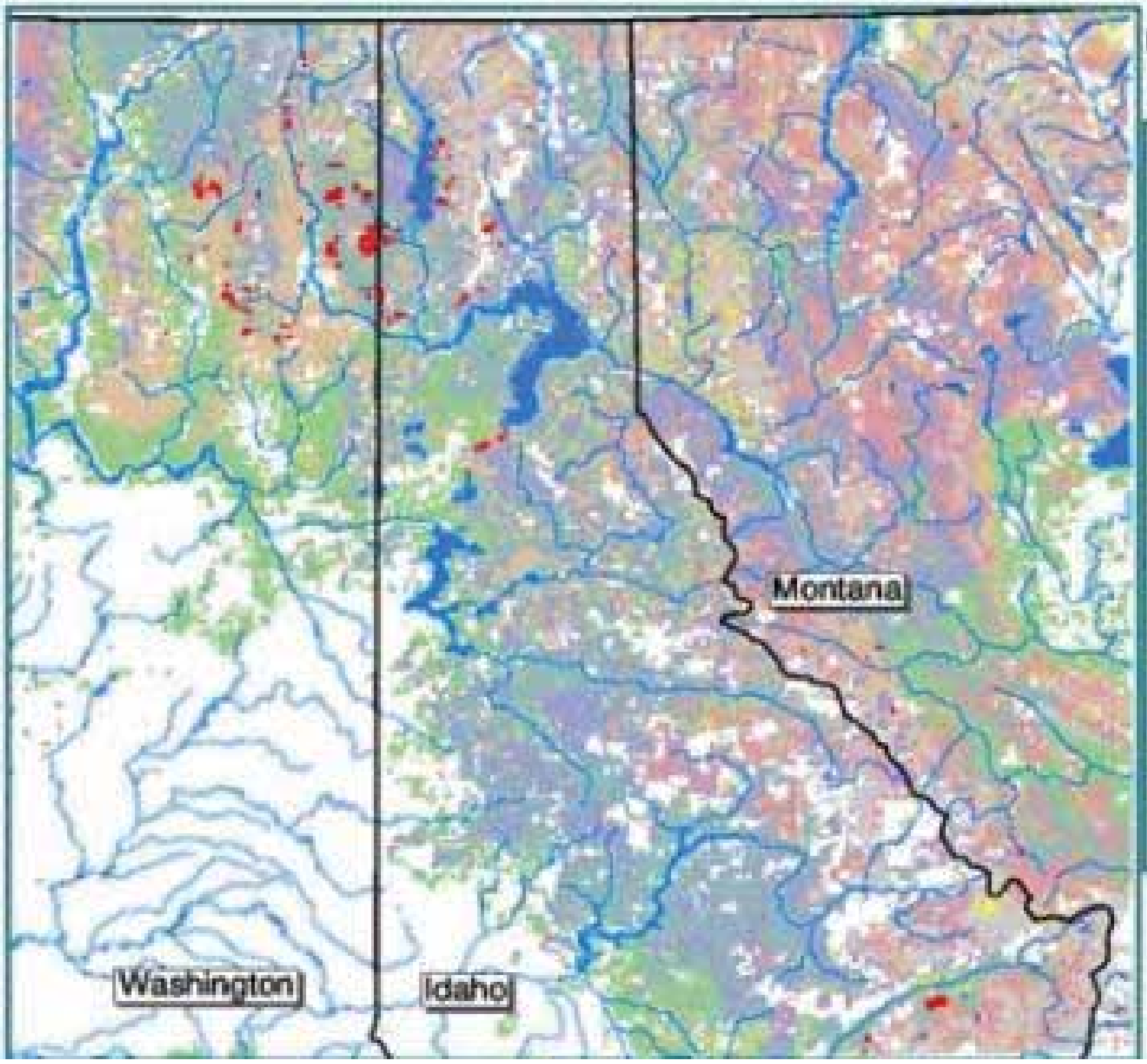

Current Cover Types

LEGEND

Major Rivers

State Border

Cover Types

- Engelmann Spruce/ Subalpine Fir
- Grand Fir/White Fir
- Interior Douglas-fir
- Int. Ponderosa Pine
- Lodgepole Pine
- Mt Hemlock
- Water
- Western Larch
- Western Redcedar/ Western Hemlock
- Western White Pine
- Whitebark Pine

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Life Cycle

Spring

Life Cycle

Summer:
intensifies on Ribes

Fall:
infects needles

Branch swellings/discoloration

Sporulating Cankers

easiest positive diagnosis

Applying water to cankers
makes them easier to see

Other Indicators

Girdles branchesCauses top-kill

Management Options

- Planting stock with improved resistance
- Pruning to increase survival
- Leaving healthy seed trees
- Controlling *Ribes* plants

Dwarf Mistletoes

- Obligate parasites of living hosts
- Host specific (but on most conifers)
- Cause loss of vigor, growth loss, branch dieback, even tree death
- Slow spread (by seed)
  - Can take 6-8 years from infection to seed production


Montana:
2.4 million acres
North Idaho:
730,000 acres

Dwarf Mistletoe Control:

- species conversion
- seed tree + overstory removal
- partial sanitation cuts
- prune brooms
- do nothing

Decays

- Important to wildlife
- Are Nature's "recyclers"
- Produce distinctive decay & fruiting bodies
- Not usually tree killers

Decay in the wrong place can be a problem

Brown Cubical Root and Butt Rot

- Major cause of decay & windthrow
- Major Hosts: Douglas-fir
- Other Hosts: All conifers

Indian Paint Fungus

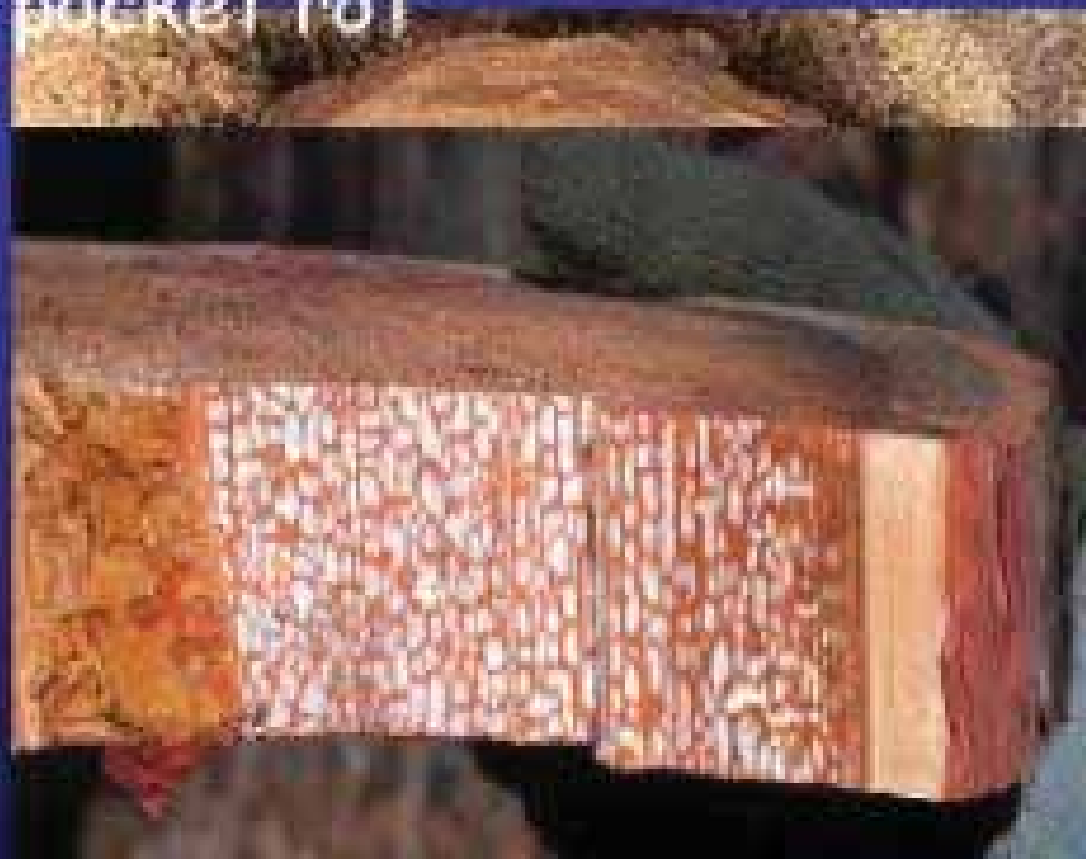
- Main cause of volume loss in True Firs and Hemlock
- Advanced decay is yellow to red-brown stringy rot

Red "Belt" fungus

- One of the most common wood decay fungi in NW
- Decays nearly all dead conifers and many hardwoods

Red Ring Rot - White pocket rot

- Most western conifers - esp. white pine and larch
- Early decay red stain in the heartwood
- Advanced decay white pocket rot



Pouch Fungus

Small, round, white to tan fruiting bodies usually develop on conifers 1-3 years after beetle attack

Minimizing Decay Damage

- Much of decay is desirable
  - Nutrient recycling
  - Wildlife habitats
- Avoid wounding
- Species manipulation
  - Use less susceptible species

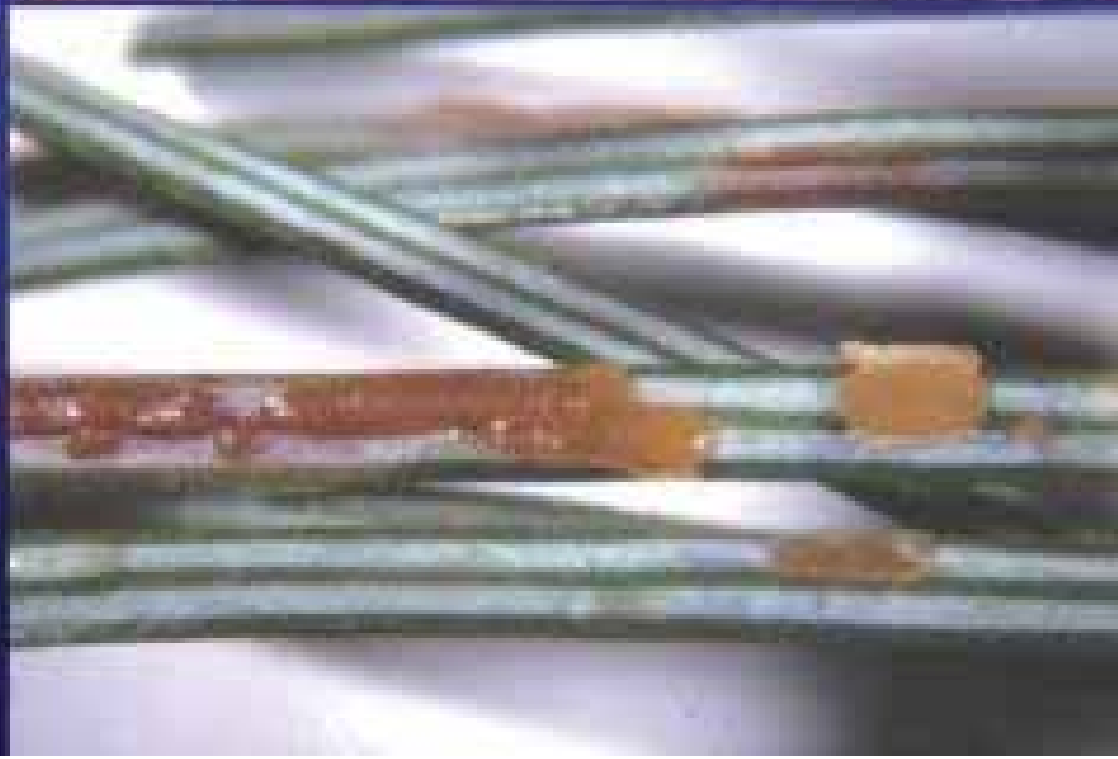
Foliage Diseases

Symptoms of Foliage Diseases

- Usually on a single species
- Usually on one age-group of needles
- Usually worst near the bottom of crowns
- Favored by moist weather conditions
- Most are weak pathogens

Lodgepole pine needlecast

Rhabdocline Needle Cast



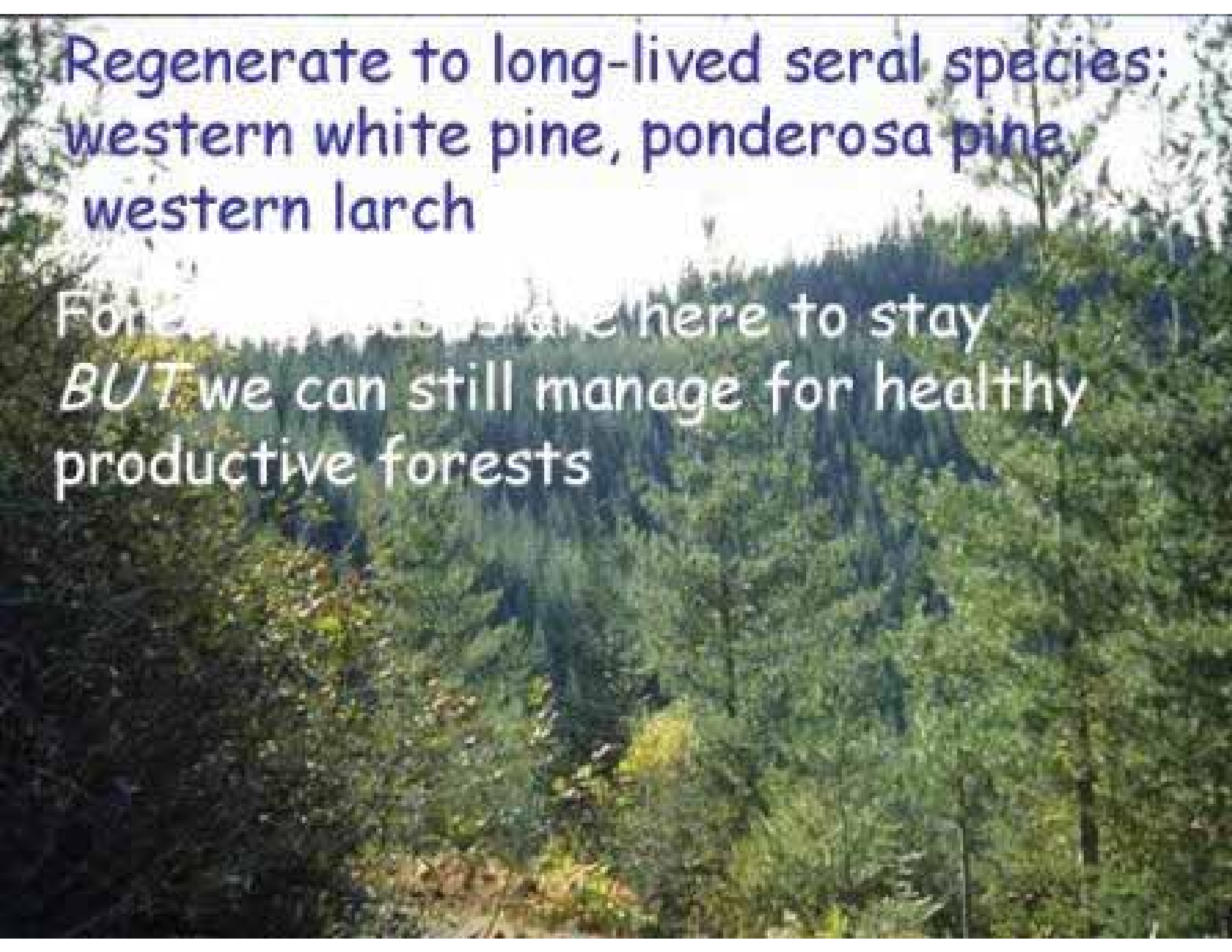
Western Larch

Needle Blight

Needle Cast

Foliage Disease Management

- Species manipulation (change species)
- Remove most susceptible individuals
- Thin/prune to dry out environment
- Let 'em out grow it
- Fungicides (last resort - nurseries, homes, Christmas trees)


Regenerate to long-lived seral species:
western white pine, ponderosa pine,
western larch
For [illegible] here to stay
BUT we can still manage for healthy
productive forests


Reintroduce fire


Questions ??

Pine-Larch Leave Tree Harvest