



# Know your tree

and what is "normal"



Fall needle drop



Larch needle blight



Symptoms

Host tree responses  
to damaging agents



# Foliage Retention



Root disease



Tussock moth defoliation

# Crown Form



Western pine shoot borer



Douglas-fir dwarf mistletoe



## Stem/Branch Deformities



Western gall rust



Balsam woolly adelgid

## Resin Flows



Douglas-fir beetle

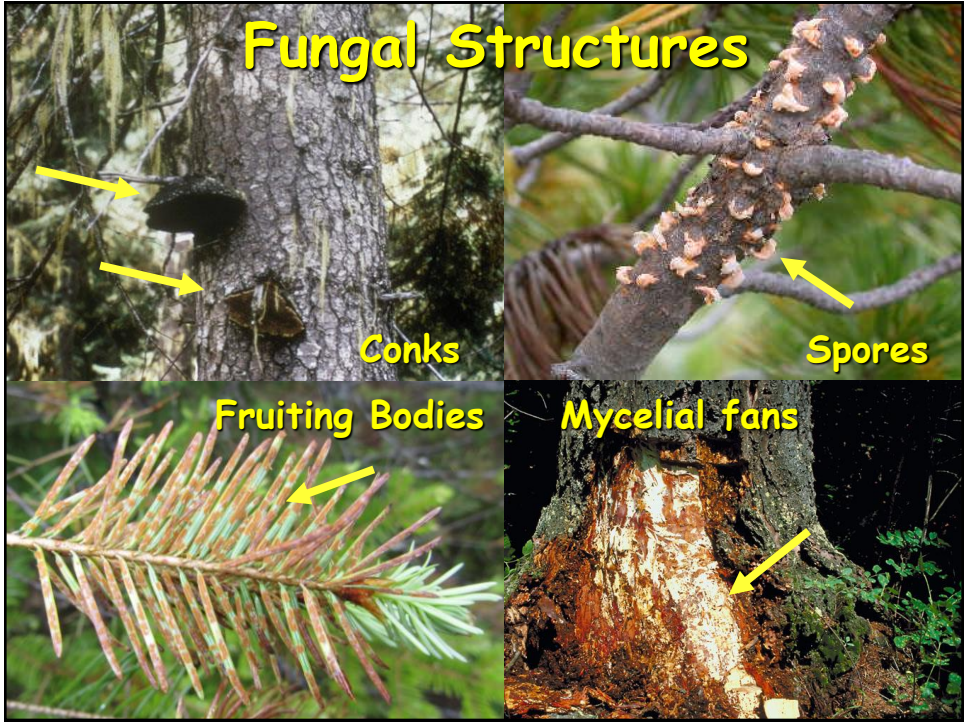


White pine blister rust











# Gallery Patterns

Douglas-fir beetle



Western pine beetle



Fir engraver



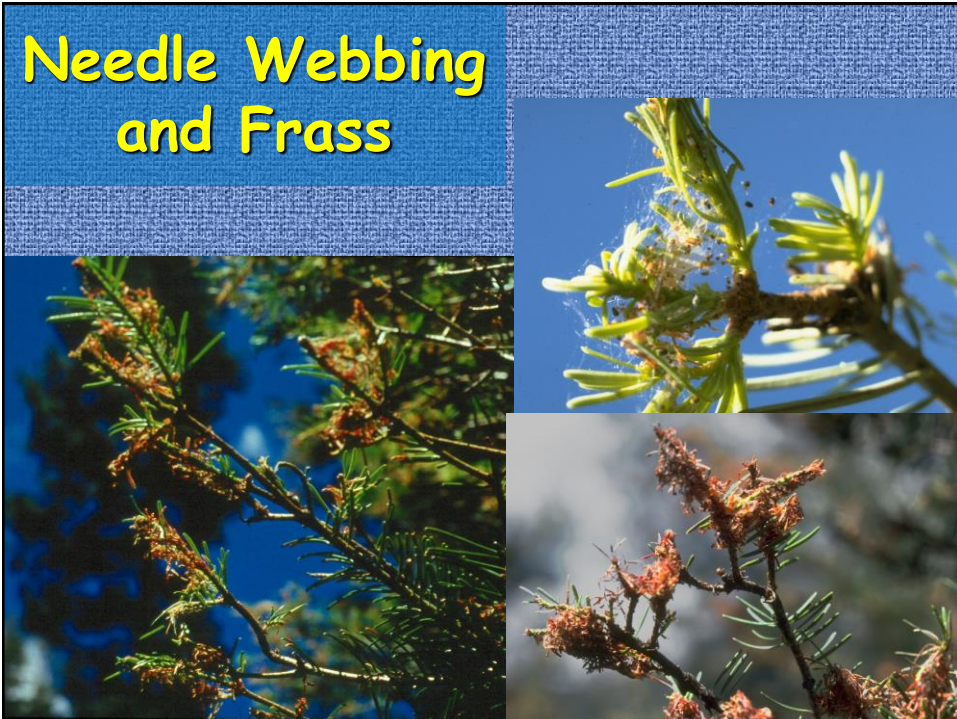
## Insect Larvae



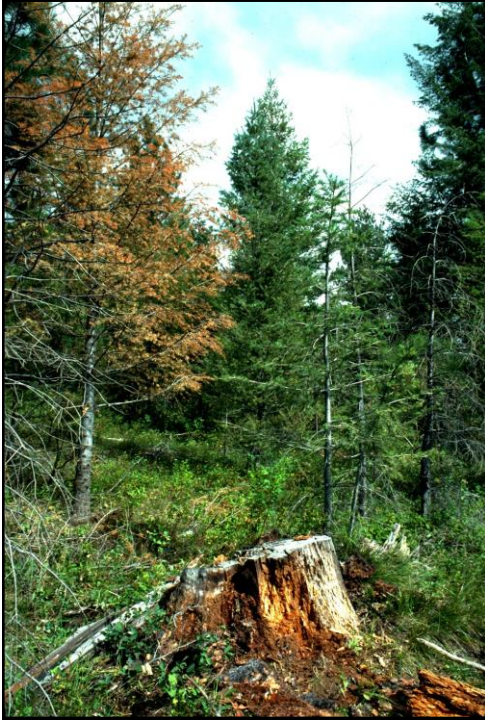
## Dwarf Mistletoe Plants



## Needle Webbing and Frass







## Patterns

Damage distribution across space and development over time, at several levels of scale; associations.



California five-spined ips

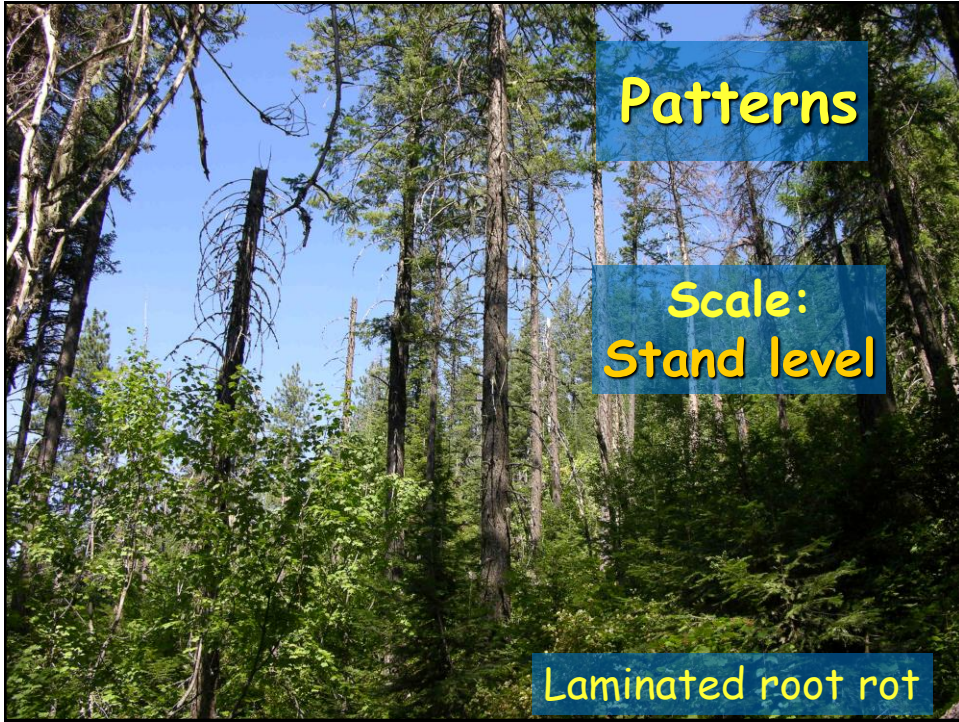
## Patterns

Scale:  
Individual tree



Dothistroma needle blight

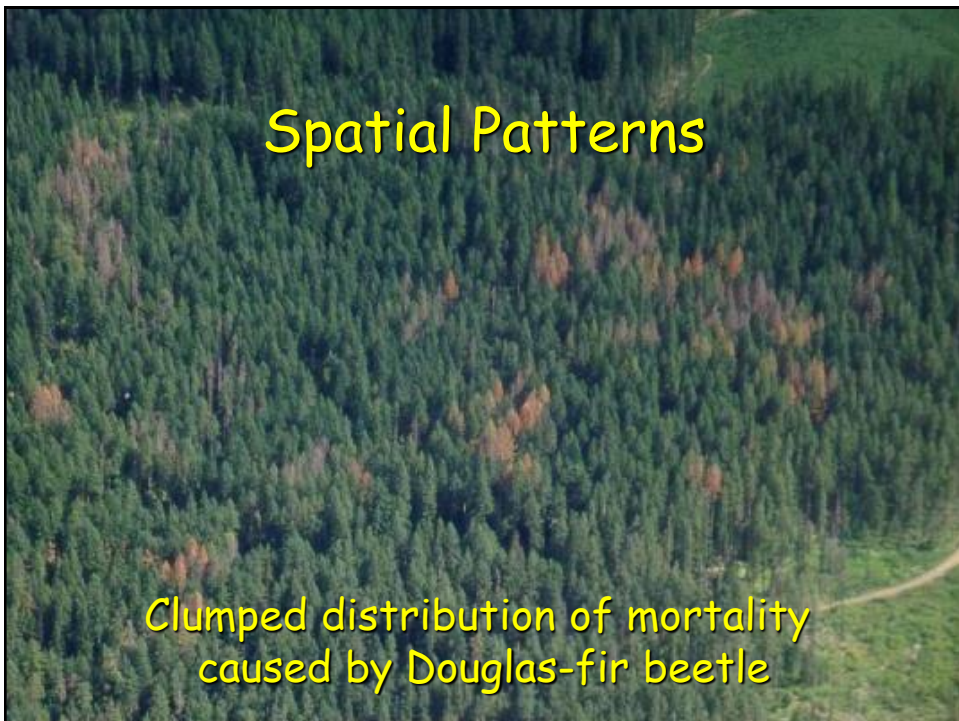




Patterns

Scale:  
Stand level

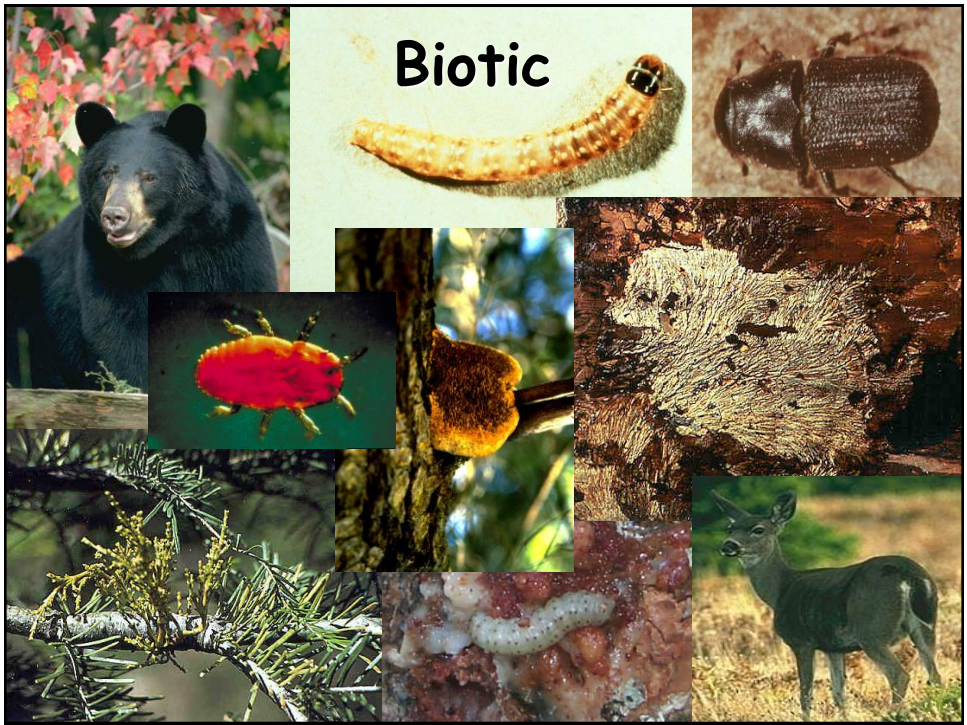
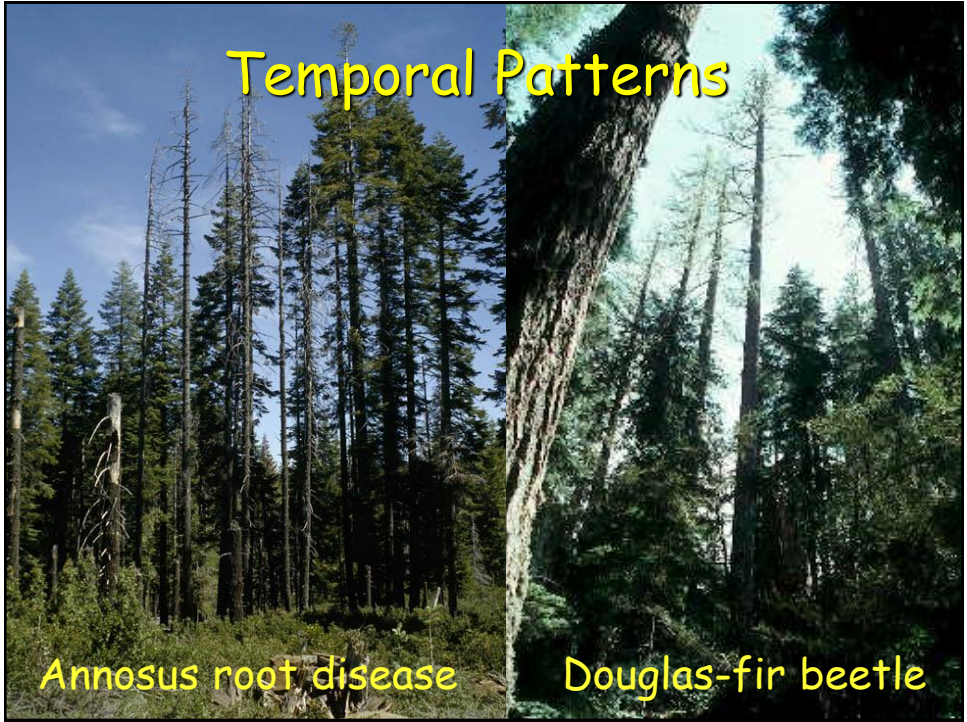
Laminated root rot



Spatial Patterns

Clumped distribution of mortality  
caused by Douglas-fir beetle









## Biotic vs. Abiotic Agents

### Biotic

- Host specific
- Non-uniformly distributed
- Damage associated with tree attributes
- Signs

### Abiotic

- Not host specific
- More uniformly distributed
- Damage associated with geographical or physical features
- No signs



## Complexes are Common

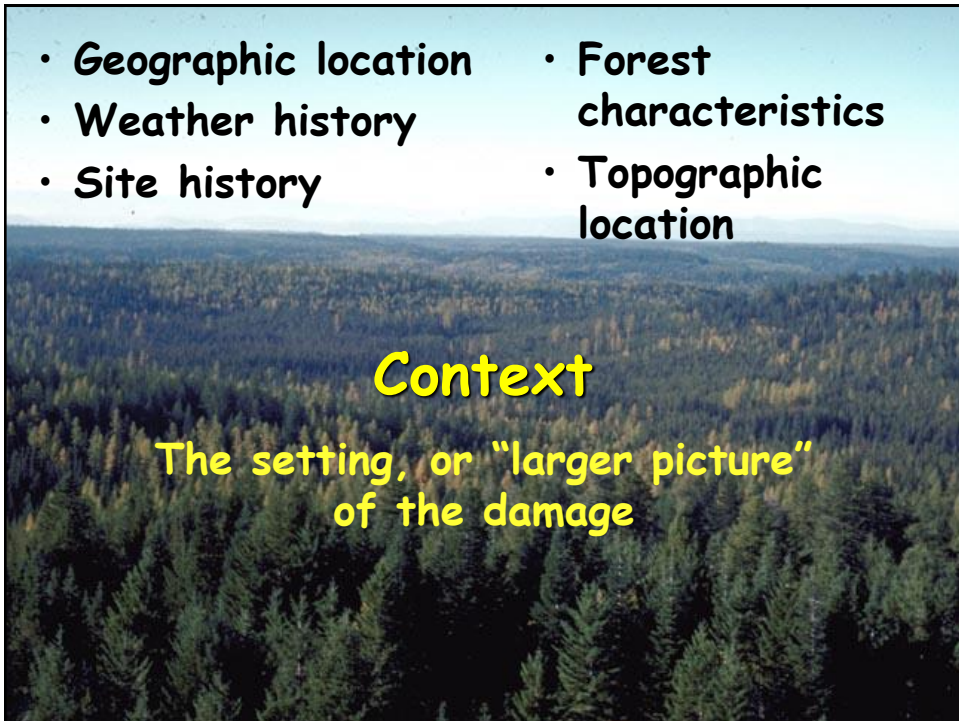
### Examples:

- root diseases/bark beetles
- bark beetles/wood borers
- dwarf mistletoes/stem decay fungi
- canker-causing rust fungi/rodents
- offsite seed source plantings/foiar pathogens

- Geographic location
- Weather history
- Site history
- Forest characteristics
- Topographic location

## Context

The setting, or "larger picture" of the damage





## Steps of Diagnosis



Observe  
damage





## Note symptoms and their pattern of distribution

- **Symptoms:** Tree mortality; sparse, fading foliage; stand openings
- **Pattern:** Progressive mortality
- **Species affected:** Douglas-fir, true fir
- **Size:** All



## Search for signs

Chop into dead tree boles to look for beetle galleries





**Examine the base of trees to look for signs of root disease**

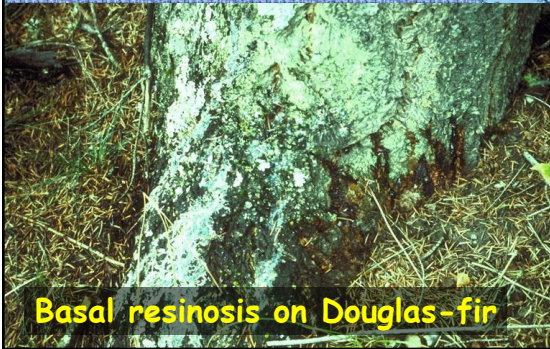


**Examine affected area for patterns of damage distribution and symptom development**





Examine nearby trees for signs and symptoms



Note context of the damage, i.e., site history, location, setting, and forest characteristics





After assembling as many clues as possible, identify potential causal agents & evaluate their relative importance

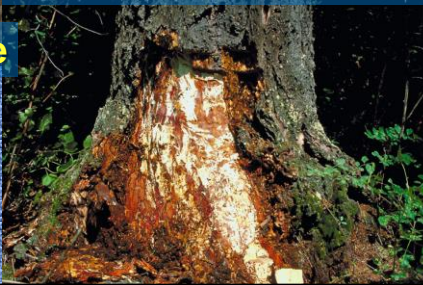


Armillaria root disease



Machine  
(compaction,  
mechanical  
damage)

Douglas-fir beetle



Arrive at diagnosis

Main problem:  
Armillaria root  
disease  
and soil  
compaction



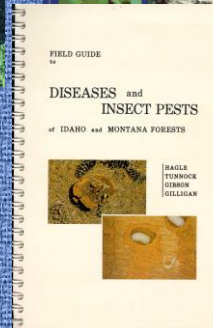
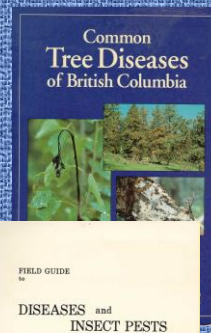
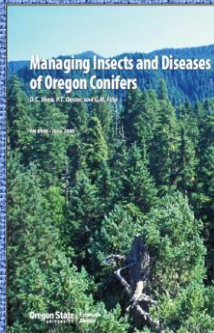
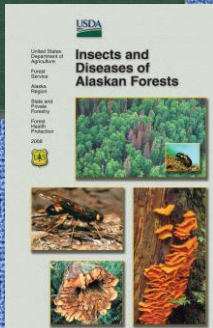
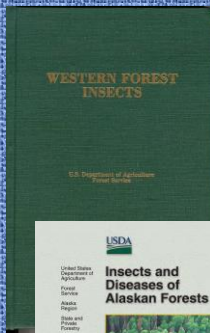


# Useful Equipment



- Pulaski
- Hatchet
- Magnifying glass
- Sturdy knife
- Binoculars
- Sample bags, film canisters, etc.
- Field guides

# References



## Acknowledgements

This presentation was originally developed by Beth Willhite, any errors are my own

