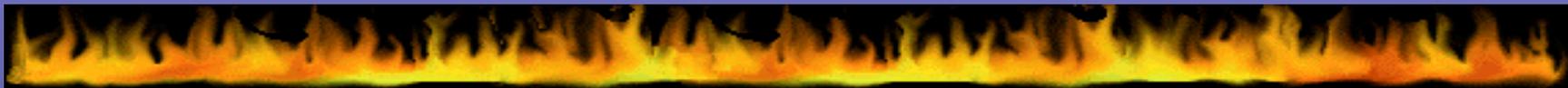




FOREST HEALTH PROTECTION
USDA Forest Service
State and Private Forestry



Natural Disturbances in Intermountain Forests



Definitions of Disturbance

- “Processes that alters birth and death rates in a patch.” (Petraitis et al. 1989)
- “External agents that cause abrupt structural and compositional changes within plant communities.” (White 1979)
- “A relatively discrete event in time that disrupts ecosystem, community or population structure and changes resources, substrate availability, or the physical environment.” (White and Pickett 1985)

Characterizing Disturbances

- **Kind:** abiotic and biotic
- **Frequency:** mean number of events per time period
- **Return Interval:** mean time between events on a site
- **Rotation:** mean time needed to disturb entire area
- **Intensity:** physical force per unit time; population levels
- **Severity:** impact on an organism, community or ecosystem
- **Magnitude:** combination of intensity and severity
- **Scale:** size
- **Duration:** length of time associated with disturbance

Abiotic Agents

wind



landslides



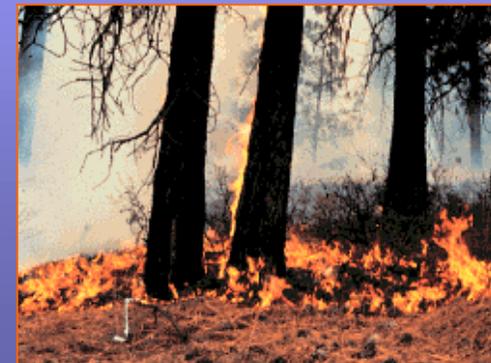
snow avalanches

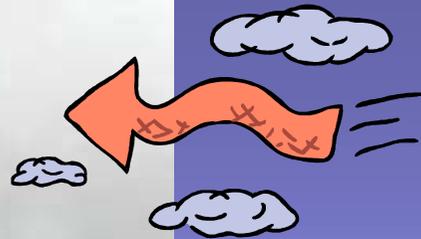


Fire



- Major disturbance of most terrestrial ecosystems
- Frequencies depend upon weather, topography, fuels and ignition sources
- Infrequent, high intensity fires are most severe





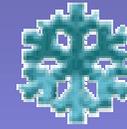
Wind

- Major force of patch and gap dynamics
- Shallow root systems, root disease and forest edges
- Damage strongly related to elevation, aspect and vegetation structure

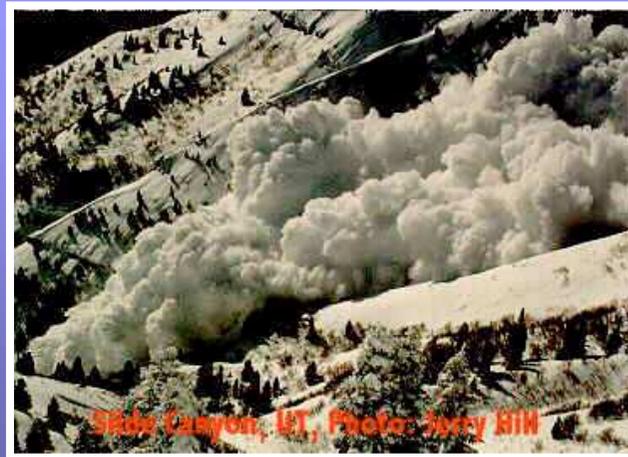




Snow Avalanches



- Climate and mountain weather
- The mountain snowpack
- Terrain



Biotic Agents

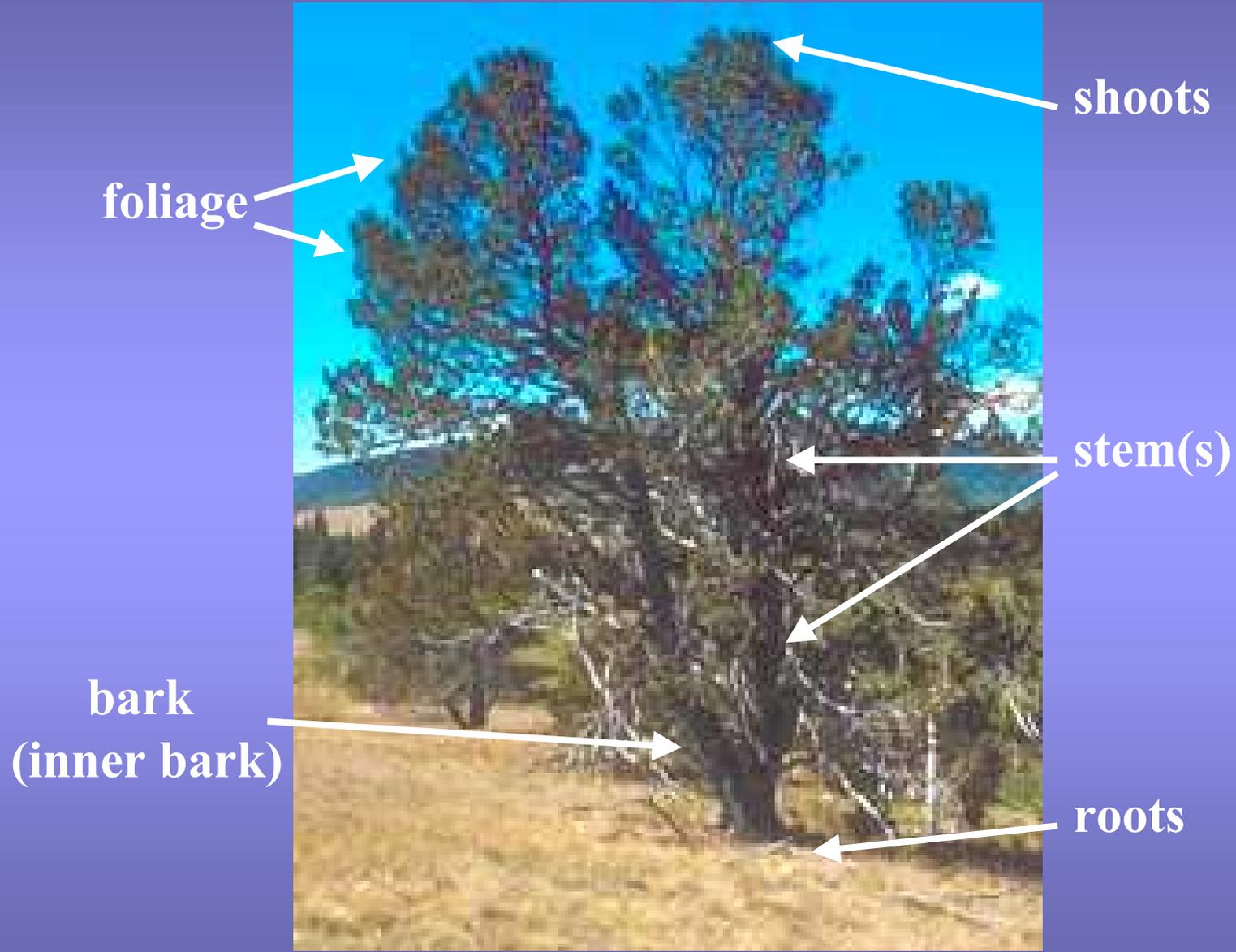
diseases



insects



dwarf mistletoes



shoots

foliage

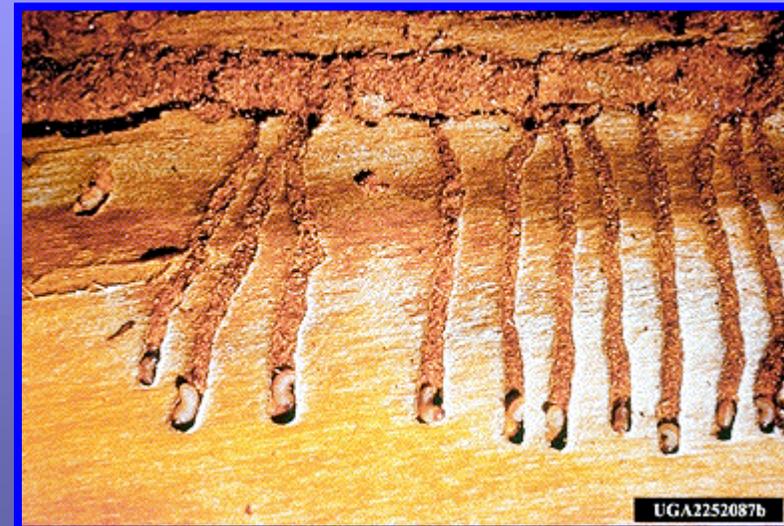
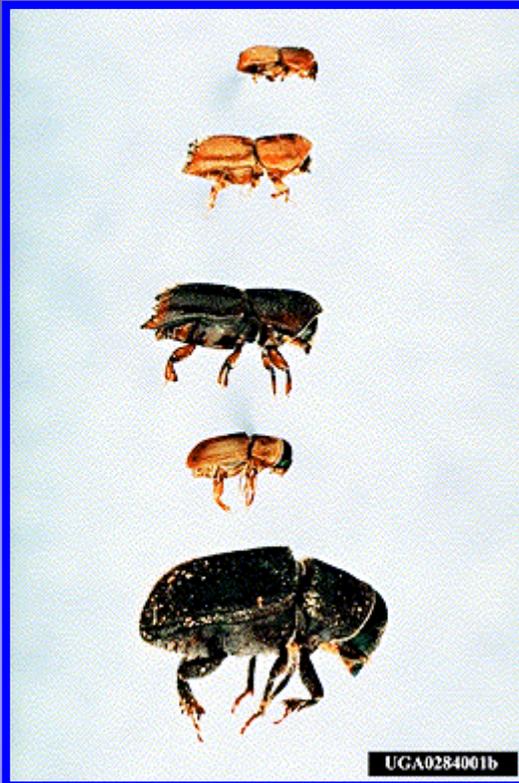
stem(s)

bark
(inner bark)

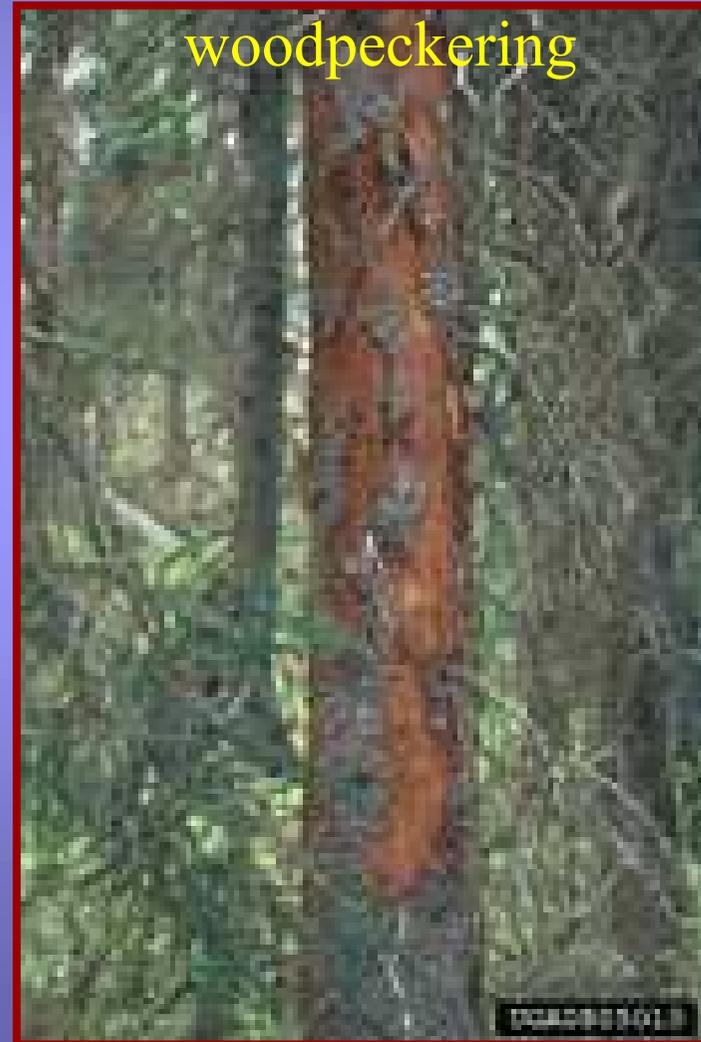
roots

Bark Beetles

- Tree mortality results from larval feeding in the inner bark of host trees
- Often ecosystem/species specific
- Primary or secondary agents
- Outbreaks related to stand conditions



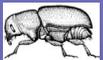
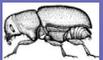
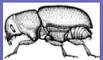
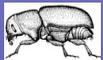
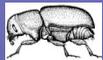
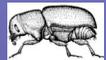
Signs and Symptoms





Intermountain Bark Beetles

- **Pinyon engraver:** outbreaks related to drought; multiple generations per year
- **Mountain pine beetle:** attacks ponderosa, lodgepole and limber pines; one generation per year
- **Douglas-fir beetle:** pocket mortality; one generation per year
- **Fir engraver:** horizontal galleries; top-kill trees
- **Engelmann spruce beetle:** prefers down host material, 2 year life cycle



pinyon engraver, NV



mountain pine beetle



spruce beetle, UT



Defoliators

- Larval feeding on foliage, buds and cones
- Stress or weaken trees; reduced growth
- Top-kill trees or branches
- Mortality may occur with successive years of defoliation
- Outbreaks related to stand conditions

UGA0886008

Signs and Symptoms

cocoon



chewing



discoloration



webbing



Intermountain Defoliators



- Fall cankerworm: oaks, maples
- Sawflies: pinyon and ponderosa pines
- Douglas-fir tussock moths: Douglas-fir, spruce
- Western spruce budworm: Douglas-fir, spruce subalpine fir
- Forest tent caterpillar: cottonwoods, aspen, chokecherry



western spruce budworm



western forest tent caterpillar



fall cankerworm

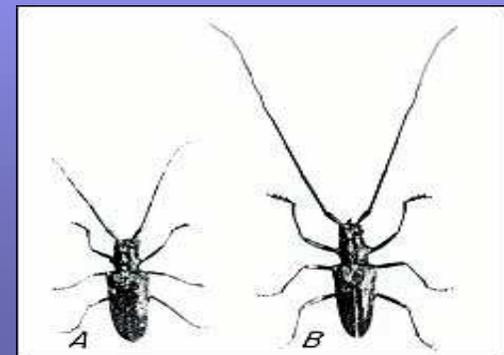


Douglas-fir tussock moth

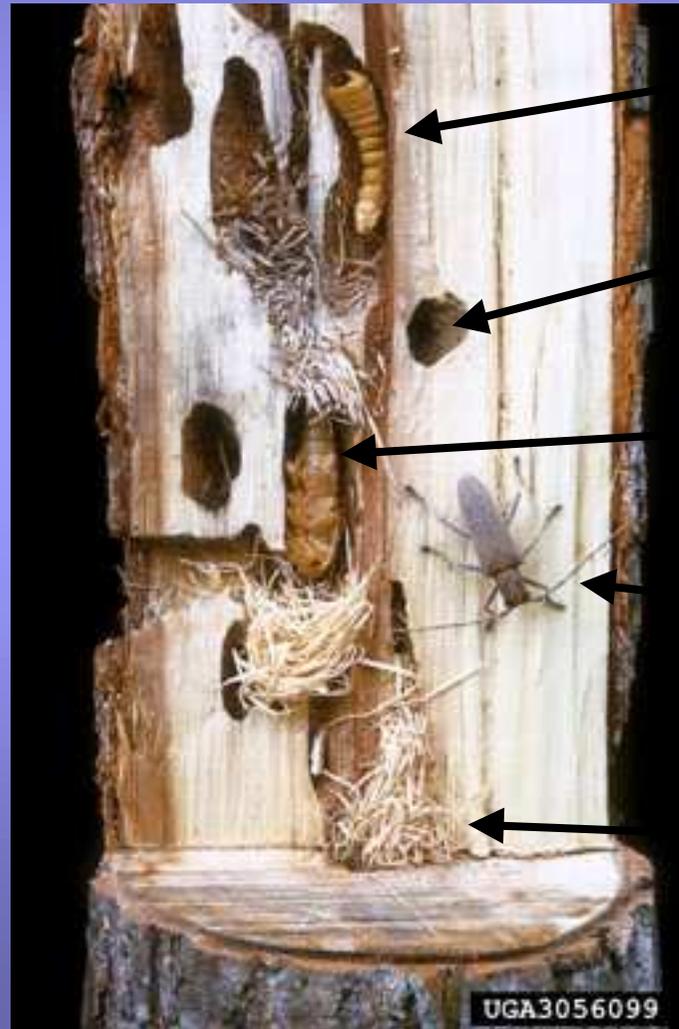


Borers

- Larvae feed within the inner bark and wood tissue
- Causes structural weakness
- Secondary agents
- Create entry courts for decay fungi
- Beetles, moths, ants and wasps



Poplar Borer



Larvae

Larval Tunnels

Pupa

Adult

Frass

UGA3056099

Signs

Entrance hole with frass



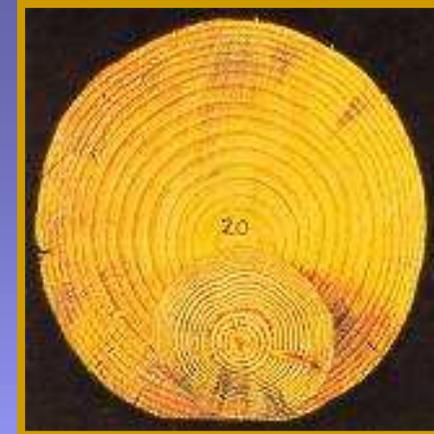
Aspen failure due to excessive boring

Pinyon Pitch Mass Borer

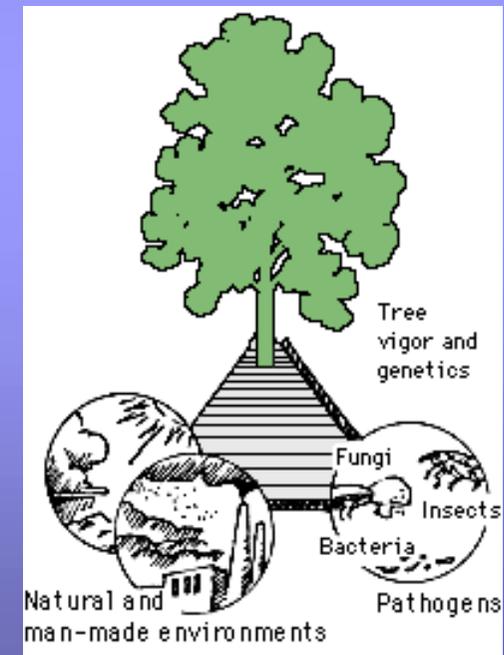




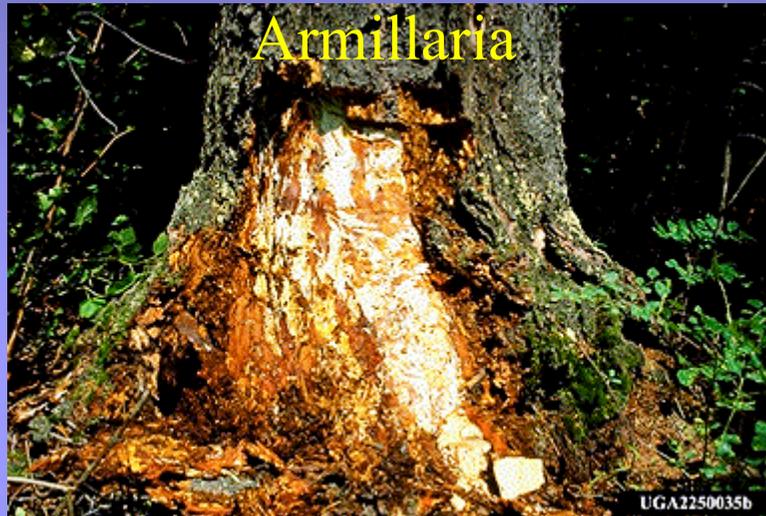
Diseases



- Fungi, bacteria and viruses
- Degrade tissues in all parts of the tree
- Stress, reduced growth and abnormal growth
- Predispose trees to other agents
- Root diseases, decays, cankers, rusts, foliar diseases and mistletoes

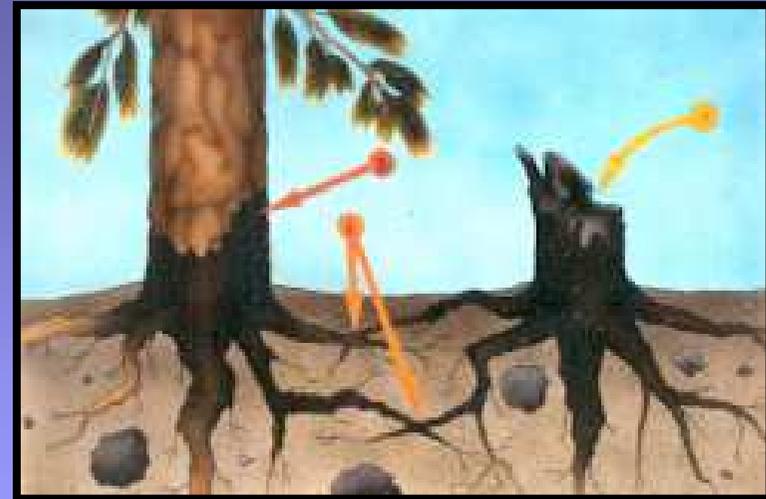


Root Diseases





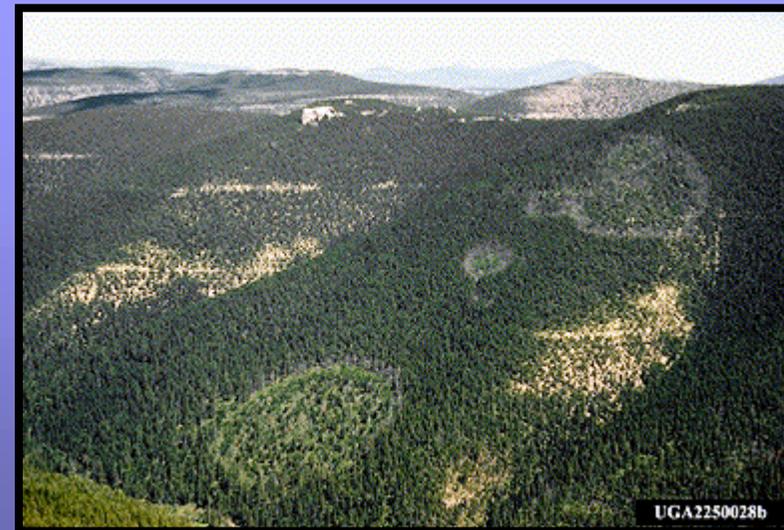
crown symptoms



spread



downed trees



mortality centers

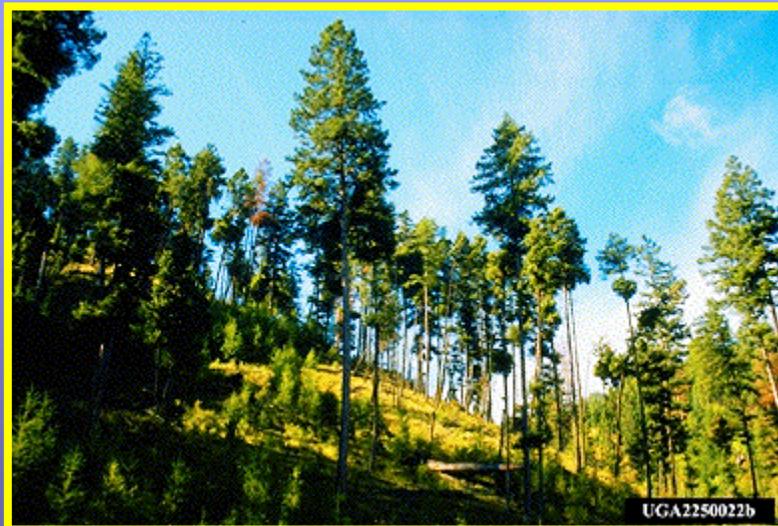
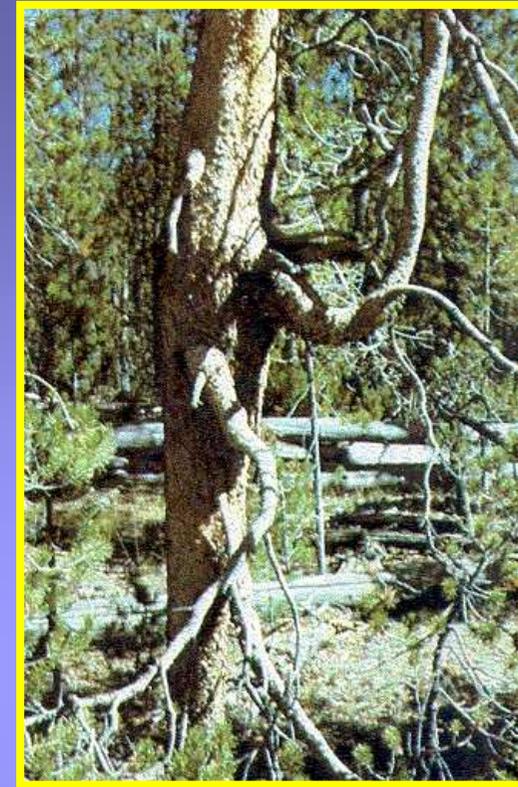
Decays

- Invade wood tissues through wounds



Mistletoes

- Leafless parasitic plants
- Host specific
- Explosive seeds
- Brooming; tree stress



Foliar Diseases

- Confined to leaves and needles
- Attack current or older foliage, rarely both
- Most damaging to young trees



aspen leaf blight



fir broom rust

Effects on Forest Ecosystems

- Endemic populations create small gaps
- Important for decomposition and nutrient cycling
- Epidemics disturbing large areas result in major structural or species changes
- Alter fuels profiles and complexes
- Predispose trees to other agents

