# Diseases Affecting Regeneration in Alaska's Boreal Forest

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# Disease

Any malfunctioning of host cells & tissues that results from continuous irritation by a pathogenic agent or environmental factor & leads to development of symptoms.

# Pathogen

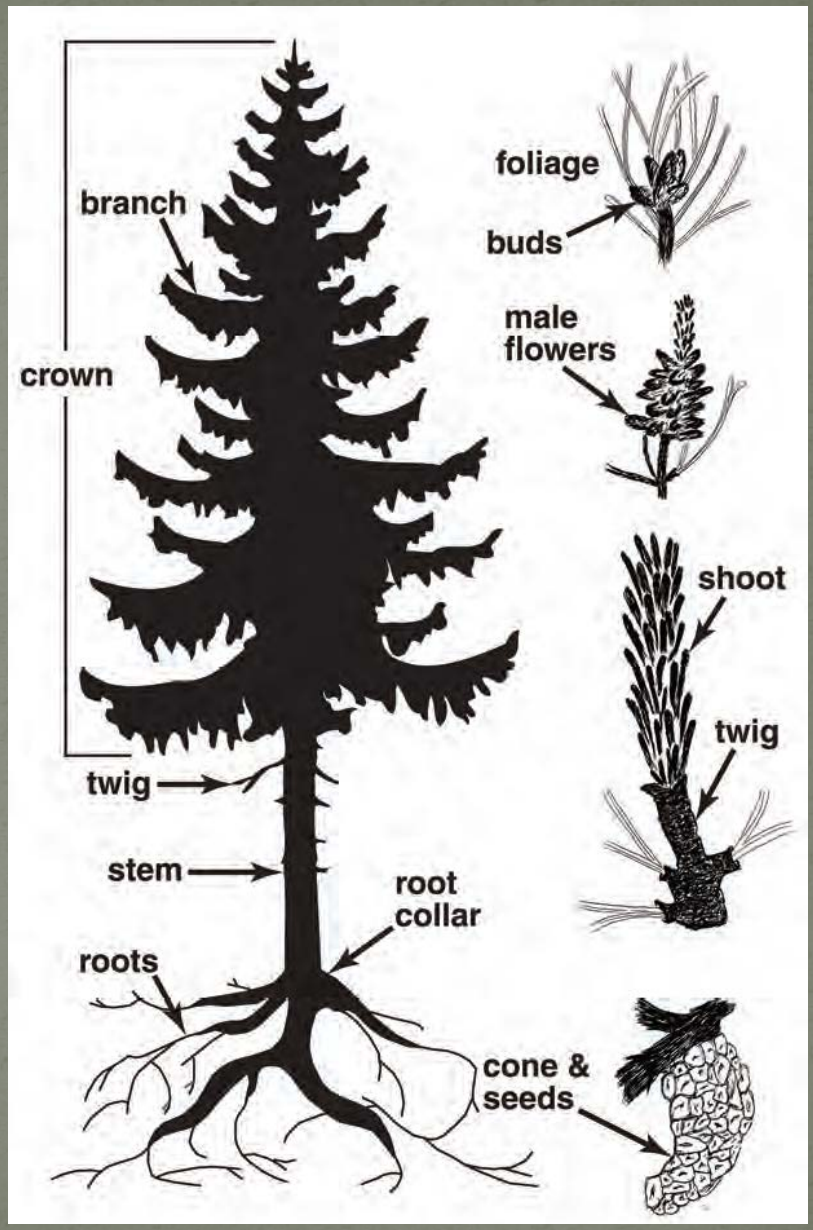
An organism that can incite disease & can be transmitted.

- Most forest pathogens are FUNGI
- Parasitic higher plants, protozoa, viruses, viroids, bacteria, nematodes, phytoplasmas
- Some insects spread disease

# Disease Classes

- Root & butt diseases
- Stem & Branch Diseases
  - Cankers
  - Stem decays
  - Stem rusts
  - Broom rusts
  - Parasitic plants
- Foliar Diseases
- Shoot Diseases
- Noninfectious disorders

## Tree Parts Commonly Affected by Forest Pests



# Root & butt diseases

**Doubly destructive:** Kills trees now growing on infested sites **& *future* trees** **** *Viable for up to 50 yrs!*

**Outright Mortality:** typically regardless of age

**Windthrow:** uprooting likely

**Butt/Stem Cull:** up to 1/3 tree volume (*Tomentosus* root rot)

**Growth Reduction:** ≥12% in severely infected trees (*Tomentosus*)

# Recognizing trees with root rot

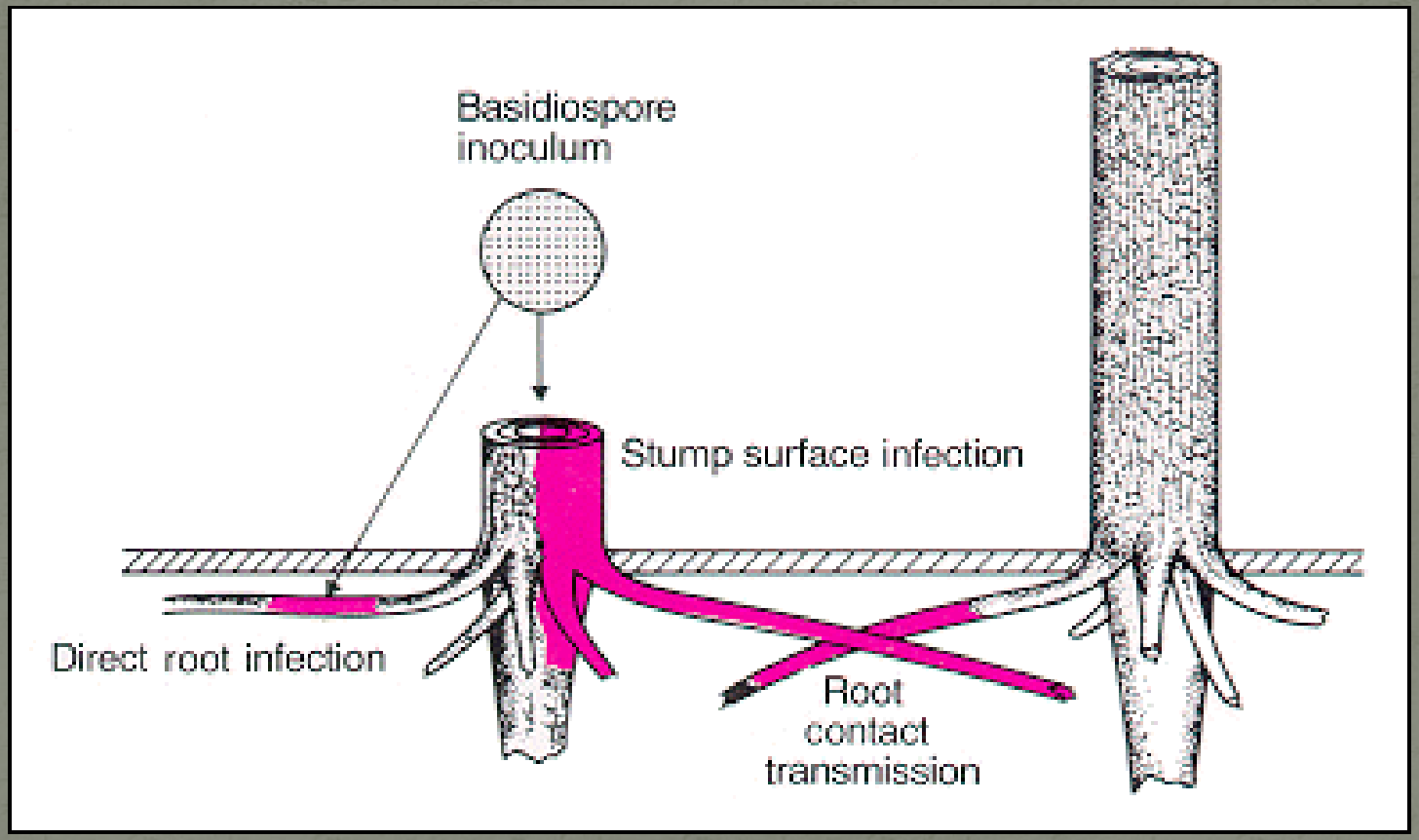
## *Above Ground*

- ✓ Distress cone crops
- ✓ Basal resin (*Armillaria*)
- ✓ Declining crown
  - Dying branches, yellow needles
  - Reduced tree growth
- ✓ Mushrooms or conks at root collar or on roots
- ✓ Uprooted trees


## *Below Ground*

- ✓ Root Decay: Accurate diagnosis depends on exam of roots and root crown

# How do root diseases spread?



# Tomentosus root rot

*Inonotus tomentosus*

**Hosts:** Spruce spp., larch

**Distribution:** SC & interior AK

**ID:** Annual conk with pores, often has embedded litter, conk on roots or tree base

**Damage:** white rot of roots, pitted to honeycombed decay; 1-few trees

**Notes:** #1 root rot of spruce

# Root & butt diseases

## Likelihood of Occurrence

From *Tomentosus Root Disease, Yukon Forest Health-Forest Insect & Disease*

| Stand Hazard: | High | Low |
|---|---|---|
| Site moisture | Dry moist | Very wet/very dry |
| Second growth stand | Infected stumps | No evidence of historic infection |
| Tree age | Old | Young |
| Stand health | Stressed/decadent | Vigorous |

# Root & butt diseases

## Tomentosus Root Rot Forest Health Stand Establishment Decision Aid British Columbia

Reich, R.W., K.J. Lewis, & A.M. Wiensczyk. 2013

### Hazard Ratings*

| BEC zone[a] | Subzone | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BWBS | dk | mw1 | mw2 | wk1 | wk2 | wk3 | vk | | | | | |
| CWH | ws1 | | | | | | | | | | | |
| ESSF | All | | | | | | | | | | | |
| ICH | dk | dw | mc | mk | mm | mw | vc | vk | wc | wk | xw | |
| IDF | dc | dk | dm | dw | mw | ww | all x | | | | | |
| MS | dc | dk | dm | dv | mw | xk | xv | | | | | |
| PP | All | | | | | | | | | | | |
| SBPS | dc | mc | mk | xc | | | | | | | | |
| SBS | dh | dk | dw | mc | mh | mm | mk | mw | vk | wk1 | wk2 | wk3 |
| SWB | All | | | | | | | | | | | |

Hazard Rating Key

- High
- Medium
- Low

* Hazard denotes relative average severity on spruce. Hazard increases on higher hazard site series, which may be drier or hotter than the zonal site series. Ratings are based on expert opinion, known disease biology, and current climatic conditions.

[a] See Meidinger & Pojar (1991) for an explanation of the Biogeoclimatic Ecosystem Classification (BEC) zone, subzone, and variant abbreviations.

## Harvesting Considerations

- Before developing a harvest plan, visually assess for the presence of root disease.
- If there is a high incidence of root disease, avoid partial cutting or thinning as this may result in increased inoculum in cut stumps.
- Pre-harvest surveys for tomentosus are very expensive.
- Disease distribution is important: aggregated infection centres may be stratified for treatment, whereas adjacent areas might not require treatment.
- Stump-top surveys to determine the incidence of advance decay in the harvested trees can help determine if white spruce can safely be replanted on the site.
- Alternatively, the simplest assessment method is to tally the number of affected butts at the log decks during harvesting.

From *Tomentosus Root Disease, Yukon Forest Health-Forest Insect & Disease & Tomentosus Root Rot Forest Health Stand Establishment Decision Aid – British Columbia*

# Root & butt diseases

## Silvicultural Considerations

- Treatment strategies are usually based on either inoculum reduction (e.g., stump removal, push-falling) or (most commonly) the planting of less susceptible species.
- If there is a high incidence of advanced root disease, encourage the growth of less susceptible birch and aspen either by planting or natural regeneration.
- If planting susceptible species, trees should be planted at least 3 m from old, infected stumps.
- Stocking in young stands may be reduced by up to 10% by age 20

From *Tomentosus Root Disease, Yukon Forest Health-Forest Insect & Disease & Tomentosus Root Rot Forest Health Stand Establishment Decision Aid – British Columbia*

# Armillaria root disease

*Armillaria spp.*

**Hosts:** All tree species in AK
***** opportunist on stressed trees *****

**ID:** rhizomorphs and mycelial fans; annual, gilled mushroom;

**Damage:** white stringy rot

**Remarks:** Humongous fungus: 2,800 ac. originated >2,400 yrs BP; bio-luminescent

# Shepherd's Crook *Venturia macularis; V. populina*

**Hosts:** Aspen & balsam poplar

**ID:** Angular black spots on leaves & twigs in spring followed by leaf curl & hooked twigs

**Spread:** Aerial spores & possibly insects

**Control:** Pruning infected branches

**Notes:** Tend to be most damaging to young plants & tissues. Young trees may be killed, stunted, or suppressed

# *Spruce Needle Rust*

*Chrysomyxa ledicola*

**Hosts:** Spruce spp. & Labrador tea

**Distribution:** throughout AK

**ID:** Orange pustules & spores produced on needles gives tree distinct orange tinge

**Damage :** premature leaf and needle loss, growth reduction.

**Notes:**

- Causes premature defoliation & growth loss, Boggy sites favorable to disease
- Sporadic large outbreaks reported

# Hardwood Leaf Rusts


*Melampsoridium betulinum*

**Hosts:**

- Birch – *Melampsoridium betulinum*
- Aspen & cottonwood (true fir, spruce, hemlock, pine) – *Melampsora* spp.

**ID:** Orange or yellow spots on leaf surfaces; if conifer host required, orange pustules present on needles

**Spread:** Spores spread from conifers to hardwoods or cycles on hardwoods alone

**Control:** Plant resistant spp. on high value sites known to have rust fungi present

**Notes:** Host range throughout AK.


Thank you! Questions?