Hardwood Trunk Rot

Yukon Forest Health — Forest insect and disease

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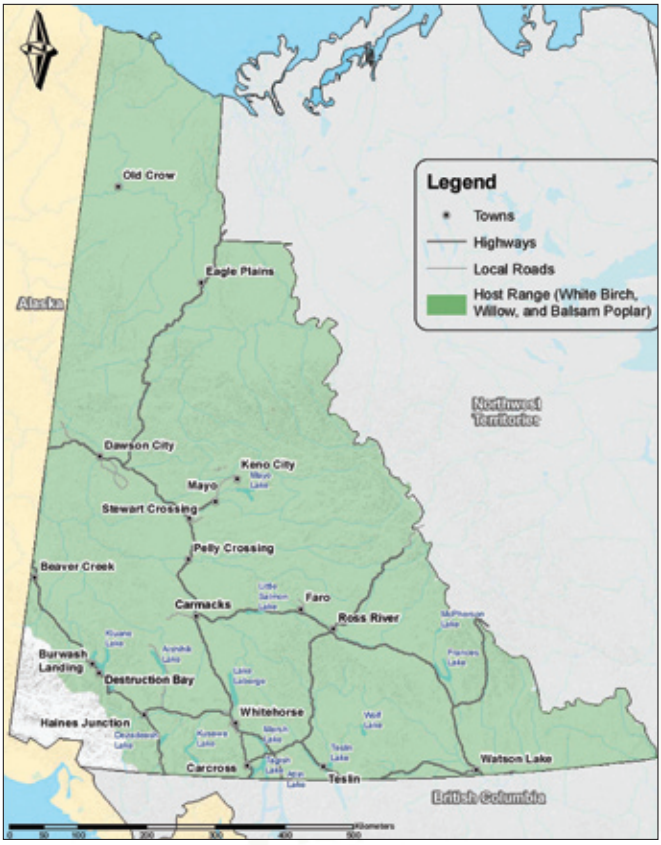
Yukon
Energy, Mines and Resources
Forest Management Branch

Introduction

Hardwood trunk rot (*Phellinus igniarius*) causes white trunk rot in a wide variety of hardwoods throughout North America. In Yukon, it has a broad host space infecting white birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), and willow (*Salix spp.*). Hardwood trunk rot is a true heart rot confined solely to the heartwood of the tree. Infection is initiated through a wound such as a broken branch stub. Hardwood trunk rot is unique because it rarely attacks dead or down trees. In Yukon, the disease is present in mixed and deciduous forests though no severe or widespread infections have been recorded. *P. igniarius* is less aggressive than its relative *P. tremulae* but the fungus has an economic impact on timber grown for commercial purposes and in recreation sites.

Host Range for Hardwood Trunk Rot



(Source data: Yukon Government Forest Inventory Data [2008] and U.S. Geological Survey [1999] Digital representation of "Atlas of United States Trees" by Elbert L. Little, Jr. (http://esp.cr.usgs.gov/data/little/)
Disclaimer: The data set for historic incidence is likely incomplete and only extends from 1994–2008. Endemic or outbreak populations may have occurred or may currently exist in non-mapped locations within the host range.

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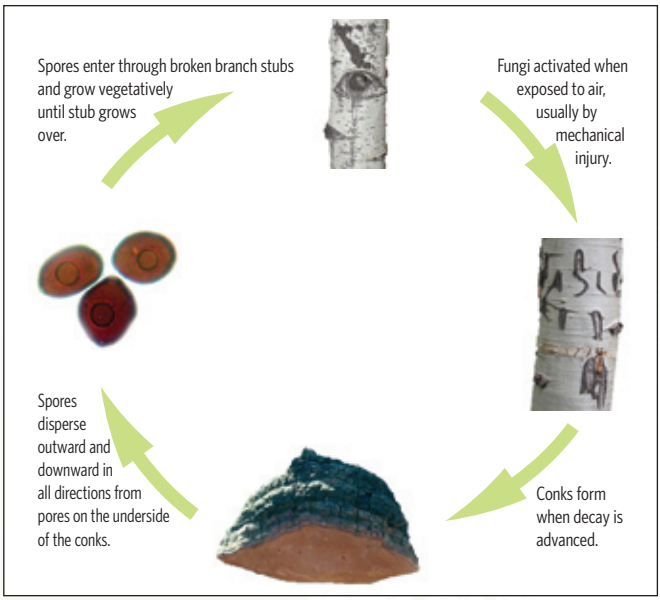
Life Cycle



The disease cycle of *P. ignarius* is poorly understood but it is similar to other polypore fungi such as Indian paint fungus (*Echinodontium tinctorum*) and aspen trunk rot (*P. tremulae*):

1. *P. ignarius* spores generally enter new hosts through broken branch stubs.
2. Mycelia develop in the branch stub until it is overgrown. The fungi then enters a resting state, in which it can remain for up to 50 years or more without causing damage.
3. Fungi are activated from the resting state when exposed to air, usually by mechanical injury. The decaying state of the fungus is then active and spreads within the heart wood to various extents depending on a tree's vigor.
4. On infected trees, the vegetative or decaying stage of the rot fungi gives rise to fruiting bodies. Generally, conks only form when decay is advanced and the food source is limited. Conks are perennial and may form and release spores for up to 10 years. Usually conks appear under old branch stubs.
5. Spores are dispersed outward and downward in all directions from the pores of the conks. The spores are windborne and infect trees as per step 1.

Host Species Attacked and Damage

Tree species attacked in Yukon: White Birch, *willow spp.*, black cottonwood (*Populus trichocarpa*) and balsam poplar are highly susceptible.

During the initial stages of infection, trees may not exhibit any symptoms. As the disease progresses, thinning crowns with sparse foliage may be a sign of infection. When decay is advanced, conks will be visible. A single conk on the stem of a tree usually indicates advanced decay within the tree. In cases of advanced decay, tree mortality occur or the stem may be weakened, resulting in stem breakage. Tree failures occur mid-stem with many trunk rots, including *P. ignarius*. The severity of the disease increases with stand age because older trees have a higher proportion of the volume as heartwood.

In its early stages, the damage caused by the fungus appears in the heartwood as a yellow-white zone surrounded by yellow-green to brown lines. By the advanced stages of decay these zone lines appear as finer black lines surrounding the zone of rot. Damage incurred by *P. ignarius* is generally not more than 10% of the total volume of a mature tree.

The conk of hardwood trunk rot is perennial and distinctly hoof-like in shape. It can grow to 11 x 20 cm in size. The upper and lower surfaces both slant towards one another at approximately 45 degrees. The upper surface is gray black to black, and roughens and cracks with age. The lower surface is light-brown and porous. In longitudinal cross section, the interior of the conk is light brown and filled with distinct tube layers that are streaked with white mycelium. The conk age can be determined from the number of tube layers. Fruiting bodies appear at branch stubs or wounds on living and dead standing trees. Punky knots that resemble the interior of the conk may be visible within the tree. Unlike other heart rots that are aggressive saprophytes as well as parasites, *P. igniarius* fungus is active only in living trees and dies with the death of the tree.

Definitions:

Saprophyte: *an organism, especially a fungis or bacterium, that grows on and derives its nourishment from dead or decaying organic matter.*

The following signs are good indicators of *P. ignarius:*

- Generally hoof-shaped conks associated with a branch stub **(photo 1)**.
- Punky knots at branch stubs.
- Stand openings with randomly oriented trees broken mid-stem.
- The tree crowns exhibit sparse, thinning foliage.
- Yellow-white areas of decay within the heartwood bordered by black zone lines **(photo 2 and photo 3)**.

Photo number:

1. **Fruiting body.** Citation: Joseph O'Brien, USDA Forest Service, Bugwood.org
2. **Wood decay.** Citation: Andrej Kunca, National Forest Centre — Slovakia, Bugwood.org
3. **Woody decay cross section.** Citation: Joseph O'Brien, USDA Forest Service, Bugwood.org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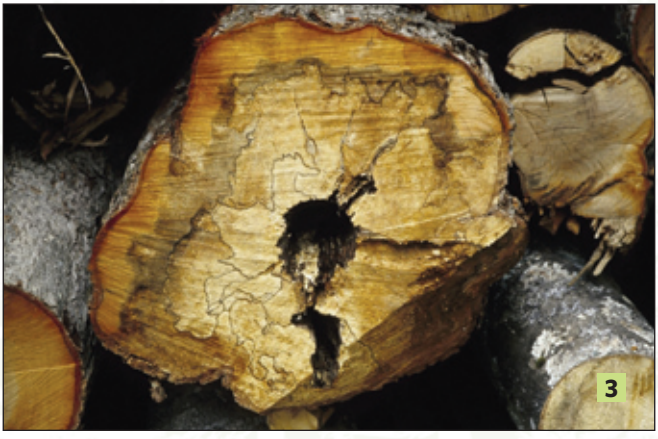
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Similar damage

P. ignarius is very similar to *P. tremulae*. *P. tremulae* will only infect aspen and will grow on dead trees, whereas *P. ignarius* grows on numerous other hardwoods (but not aspen) and not on dead trees.

Risk Assessment

The following tables summarize the likelihood of occurrence and magnitude of impact of stand level damage. These tables are a coarse guide for estimating the risk of an outbreak when populations are at endemic levels.

Likelihood of Occurrence

Tree Infection Hazard:	**High → Low**	
Tree age[1]	Old	Young
Tree health[2]	Wounded	Non-wounded

Notes:

1. Hardwood trunk rot is more severe in older trees because they contain a higher proportion of heart wood and the disease has had more time to progress.
2. Wounds activate the decay stage of the fungus.

Magnitude of Consequence

The magnitude of consequence is a subjective assessment of the potential consequences of an outbreak. This list is not exhaustive and is intended to stimulate thought on potential impacts to consider over time.

Value	Impact							
	-							+
Traditional Use[1]								
Comment:	No impact anticipated							
Visual Quality[2]								
Comment:	No impact anticipated							
Timber Productivity[3]								
Comment:	Not applicable							
Wildfire Hazard[4]								
Comment:	No impact anticipated							
Public Safety[5]	■	■	■	■				
Comment:	Hazard trees (-)							
Hydrology[6]								
Comment:	No impact anticipated							
Time Scale (years)	20+	15	10	0-5	0-5	10	15	20+
Comment:	Impact refers to a predicted, substantial positive (+) or negative (-) impact on a value for an estimated time period							

Notes:

1. In this context, traditional use values considered are hunting, trapping and understory shrub/plant use. Given that this trunk rot causes gradual and limited mortality, no impact is anticipated.
2. Given that trunk rot causes gradual and limited mortality, no impact is anticipated.
3. There is no commercial harvesting of balsam poplar in Yukon and timber productivity is not considered applicable.
4. Given that hardwood trunk rot causes gradual and limited mortality, no impact is anticipated.

5. Hardwood trunk rot infection is likely to create hazard trees by weakening tree stems and making stems more prone to breakage.

6. Given that hardwood trunk rot causes gradual and limited mortality, no impact is anticipated.

Implications of Climate Change

General Circulation Model (GCM) results in the 2007 Intergovernmental Panel on Climate Change (IPCC) report indicate that warming in northern Canada is likely to be greatest in winter (up to 10°C) and warmer by 3–5°C in summer. Mean annual precipitation is also predicted to increase (particularly in fall and winter). More rainfall is expected on windward slopes of the mountains in the west, therefore the rain shadow effect of the St. Elias Mountains may mean that southern Yukon does not experience increased rainfall. High temperatures will increase levels of evaporation and transpiration, and ultimately lower soil moisture levels. Therefore, even if summer rainfall is maintained at current average levels, higher temperatures would result in limited soil water availability and cause moisture stress in trees. Currently, climate scenarios suggest that Yukon will experience a warmer climate that will be wetter or drier in the future depending on the region.

The spores of *Phellinus ignarius* are windborne; therefore dispersal is unlikely to be impacted as a direct result of a warmer/wetter or warmer/drier climate. *P. ignarius* may benefit from warmer, drier temperatures because increased drought stress in host trees may increase colonization success. If summer conditions are wetter in the future, the opposite would be true as host trees would not be moisture stressed.

Management Options

Monitoring

Due to the limited extent of the current disease levels, this disturbance agent is best monitored with annual ground surveys. Conks are perennial and can be observed at any time of year.

Direct Control

There is no known direct control for P. ignarius. Maintaining dense healthy stands and preventing mechanical and fire damage are management strategies that will reduce the likelihood of infection.

References

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