Aspen Trunk Rot

Yukon Forest Health — Forest insect and disease

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Yukon
Energy, Mines and Resources
Forest Management Branch

Introduction

Aspen trunk rot (*Phellinus tremulae*) is the primary cause of volume loss in aspen (*Populus spp.*). The disease causes extensive decay in host trees. Aspen trunk rot is a true heart rot confined solely to the heartwood of the tree.

This heart rot is known to be present at background levels in Yukon and extensive damage has been reported. Aspen trunk rot has caused substantial volume loss in trembling aspen (*Populus tremuloides*) stands in British Columbia.

Host Range for Aspen 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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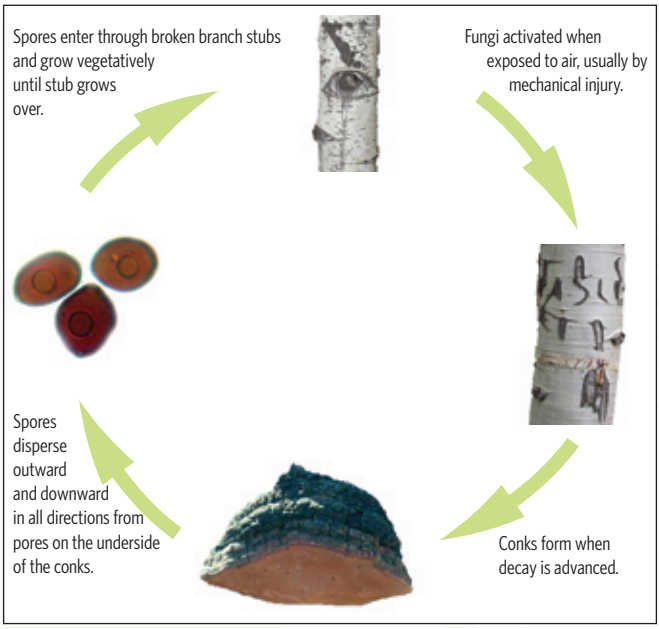
Disease Cycle



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

1. *P. tremulae* 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 tree vigor.
4. 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. They are shaped roughly like a horse's hoof, grey to black above with a light brown pore surface below.

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: Trembling aspen.

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. In cases of advanced decay, trees will die standing or the weakened stem results in breakage. Tree failures occur mid-stem with many trunk rots, including *P. tremulae*. The volume of decayed wood increases with stand age because older trees tend to have a higher proportion of heartwood. No consistent relationship between site and decay exists, though less volume is generally lost in vigorous stands on good sites. The most prominent stand level symptoms include numerous conks, on standing dead and broken stems.

In its early stages, the damage caused by the fungus appears in the heartwood as a yellow-white zone surrounded by brown lines. By the advanced stages of decay these zone lines appear as finer black lines surrounding the zone of rot. The presence of a single conk indicates a considerable amount of decay, as much as 82% of gross tree volume.

The conk of aspen trunk rot is perennial and distinctly hoof-like in shape. It can grow to 15 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, and on slash. Punky knots that resemble the interior of the conk may be visible within the tree. Trees contaminated with *P. tremulae* have a distinct wintergreen scent when freshly cut.

The following signs and symptoms are good indicators of *P. tremulae*:

- 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 decay within the heartwood bordered by black zone lines **(photo 2)**.

Photo number:

1. **Hoof-shaped conk.** Citation: William Jacobi, Colorado State University, Bugwood.org
2. **Yellow-white decay within the heartwood bordered by black zone lines.** Citation: Linda Haugen, USDA Forest Service, Bugwood.org

Similar damage

P. ignarius is very similar and *P. tremulae* was only recently designated as a separate species. *P. tremulae* will only infect aspen and will grow on dead trees, whereas *P. ignarius* grows on other hardwoods as well as Douglas-fir (*Pseudotsuga menziesii*), but has not been reported on aspen. *P. igniarius* survives only on living trees.

Risk Assessment

The following tables summarize the likelihood of occurrence and magnitude of impact of an outbreak at the stand level. 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. Rot tends to be more advanced and severe in older stands.
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 aspen in Yukon and timber productivity is not considered applicable.
4. Given that aspen trunk rot causes gradual and limited mortality, no impact is anticipated.
5. Aspen trunk rot infection is likely to create hazard trees by weakening tree stems and making stems more prone to breakage.
6. Given that aspen 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 largest 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 tremulae* are windborne; therefore dispersal is likely to be impacted as a direct result of a warmer/wetter or warmer/drier climate. *P. tremulae* 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. Warmer/drier conditions during spore dispersal could possibly increase the spread of the disease, while warmer/wetter conditions would only assist in the germination of the spores.

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. tremulae* but there are management steps that one can take to reduce the risk of infection. Maintaining dense, healthy stands and preventing mechanical and fire damage will reduce the likelihood of decay.

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