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Decay and Discoloration of Aspen

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Quaking aspen (*Populus tremuloides* Michx.) is the most widely distributed tree species in North America. It has a transcontinental range and grows under a wide variety of climatic and edaphic conditions. The commercial range includes the Lake States as well as parts of New England; it also includes Manitoba, Saskatchewan, and Alberta, Canada. Although many stands in the Rocky Mountains of the Western United States contain substantial volumes, aspen is little utilized in that area.

Throughout its range, aspen is a very defective species because it is highly susceptible to damage by insect and fungal pests. Among the many pathogens attacking aspens, those that cause decay and wood discoloration have the greatest impact on wood and fiber production (fig. 1). The amount of decay and the fungi causing this damage varies considerably throughout the tree's range. Up to 25 percent of the gross cubic-foot volume was lost to heartrots in Minnesota aspen, whereas in the Upper Pic region of Ontario decay destroyed only about 9 percent of the volume even though 69 percent of the trees were infected, and stain occurred in 20 percent of the wood. Decay in Utah damaged 18 percent of the volume, while in neighboring Colorado (where 53 percent of the trees contained decay) only 8 percent of the cubic-foot volume was affected.

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Decay

Fomes igniarius var. *populinus* (Neu.) Campb., the false tinder fungus, is the most important heartrot organism in aspen. Decay caused by this fungus is commonly called conkrot. The appearance of

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Figure 1.—Aspen pulpwood with associated discoloration and decay.

fruiting bodies (conks) on living trees is the most reliable external indicator of *F. igniarius* decay (fig. 2). Although aspen varies in its susceptibility to decay, *F. igniarius* occurs throughout the tree's range. Damage has been related to tree age, diameter, and genotypic variation, but there is conflicting evidence as to a relation with site quality and aspect. Sampled stands in the Lake States had *F. igniarius* decay in 42 percent of the merchantable-sized trees and 86 percent of the infected trees bore fungus fruiting bodies. The organism was responsible for 75 percent of the decay found in merchantable portions of the sample trees. In Colorado (where the organism was responsible for 59 percent of decay loss) only 10 percent of the trees were infected and 79 percent of these infected trees bore fruiting bodies.

The white or yellowish spongy rot associated with *F. igniarius* is generally confined to the heartwood (fig. 3). The early stage of decay is characterized by soft cream-colored wood, often with a distinct dark zone line separating it from the surrounding healthy wood. In later stages of decay, the wood becomes spongy or punky, yellowish in color, and the decayed wood contains a number of irregular concentric black zone lines. A brown stain is usually found on the outside perimeter of the decayed wood. The rot can occur throughout the length of the tree and often, in advanced stages, sapwood tissue is invaded. Occasionally the damage is so prevalent that it masks or conceals rot caused by other fungi. Although *F. igniarius* is very destructive to living trees, it apparently does not cause damage to stored logs or timber in service. Suspected entry points for the organism are dead branch stubs, cankers, and various types of injuries that extend deep into the sapwood. The shelflike or hoof-like fruiting bodies emanate from these points.

A brown mottled stain grading into yellow-brown, stringy trunk rot caused by *Radulum casearium* (Morg.) Lloyd and *Peniophora polygonia* (Pers. ex. Fr.) Bourd.

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Figure 2.—*Fomes igniarius* fruiting body on a mature live aspen stem.

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Figure 3.—*Fomes igniarius* decay column in aspen surrounded by discoloration.

& Galz. (=*Corticium polygonium* Pers.) is probably the next most common defect found in the Lake States region. Other frequently encountered trunk decay organisms are *Pholiota aurivella* (Fr.) Kumm. (=*Pholiota adiposa* (Fr.) Kumm.), *Gleocystidium karstenii* (Bourd. & Galz.) Donk, and *Polyporus dryophilus* (Fr.) Overh. Important trunk decay fungi found in the West are *P. polygonia* (=*Cryptochaete polygonia* (Fr.) Karst.), which cause a white brittle rot, and *Libertella* sp., which is associated with a white mottle top rot. The incidence of trunk infection by *P. polygonia* is greater than that of *F. igniarius*, although it causes much less decay. *Radulum casearium* is seldom found in the West.

Butt rot fungi enter the tree through basal wounds, root wounds, and connected roots. *Pholiota spectabilis* (Fr.) Kummer, *Armillariella mellea* (Vahl. ex Fr.) Karst, and *Pholiota aurivella* are among the most common. They cause a yellow-brown, stringy butt rot that usually extends upward only a few feet (fig. 4). Butt rot fungi in the West include *Collybia velutipes* (Curt. ex Fr.) Kummer, which is important in causing yellow, stringy butt rot. A white mottle rot caused by *Ganoderma applanatum* (Pers. ex Wallr.) Pat., while not quite as common, is probably more important in that it decays roots and results in tree windthrow. Other common decay organisms are *Pholiota squarrosu* (Fr.) Kummer, *Pleurotus ostreatus* (Fr.) Kummer, and *Trechispora raduloides* (Karst.) Rogers.

Discoloration

Discoloration (stain) is a very common defect found throughout the stems of aspen. It may originate as a response to wounding due to fire scars, frost cracks, branch stubs, insect or animal damage, increment-bore holes, etc. In addition, discolored zones of varying intensity often are associated with cankers and decay columns (fig. 3). This discoloration in woody tissues results from the reaction of living cells of the xylem to various agents, causing disruption of normal tissue function. Micro-organisms are often associated with discoloration but their role is not understood.

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Figure 4.—Butt rot in aspen caused by *Pholiota*.

The color of stained wood includes hues of brown, black, red, yellow, and green. Many stains occur in the heartwood before or during the development of heartrot. In the initial stages, the strength of affected tissues is not greatly reduced, but later these tissues may be weakened. In an Ontario study, nearly 20 percent of the total merchantable volume of live aspen contained a red mottle or brown stain. Another study associated *C. polygonium*, *R. casearium*, *F. igniarius*, and *Stereum purpureum* Pers. ex Fr. with a common brown stain and *C. polygonium* and *Polyporus adustus* Willd. ex Fr. with a mottled stain. In the West, *C. polygonia* is usually associated with a pink stain and *Libertella* sp. with a greenish-brown stain. Because of the different fungi and bacteria associated with the stain complex in aspen, there are too many inconsistencies between the color of stain and the associated organism to make any meaningful comparisons.

"Wetwood" is a common defect in many hardwood trees. It is the general name for discolored zones not associated with decay columns. These zones can encompass most of the cross section of the bole but generally are more restricted (see cover). Such zones are characterized by a high mineral and moisture content, by variable bacterial population, and by being impermeable to liquid. Although the discoloration in aspen largely disappears when dried, the wood is brash and subject to splitting and cracking, and has reduced strength. Because the color fades, it is difficult to detect and cull out these affected zones early in the manufacturing process.

Control

Because of thin bark, relatively minor wounds on aspen permit the entrance of various organisms into the wood beneath. There is no practical way to exclude these organisms by reducing injuries; nor is there any practical way to reduce prevalence of branch stubs through which some of the same organisms also gain entrance. Therefore, the goal in managing aspen for fiber production should be to maintain uniform, well-stocked stands and to harvest these stands before decay and discoloration losses become excessive. These losses can be minimized if cutting ages are 50 years or less in the Lake States region and between 80 and 100 years in the West.

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