

Bark Beetles of the Southern California Forests

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How Do Bark Beetles Invade a Living Tree?

Evidence of bark beetle invasion into a host tree are externally visible. Adult beetles fly to a new tree and begin boring through the bark. The tree responds by forcing pitch (or sap) out of the hole made by the beetle. As the tree pushes pitch out of the hole a pitch tube forms. The pitch tubes are conical eruptions from the bark of the tree, typically less than one inch in diameter. The appearance of the pitch tube tells whether the tree or the beetle was successful in the attack. A white pitch tube means success to the tree, the beetle was "pitched out". Careful inspection of the sticky tube often reveals a beetle imbedded within. A reddish-brown pitch tube means success to the beetle. The reddish-brown tint of the pitch is due to boring dust created by the beetle as it begins to form galleries between the bark and [sapwood](#) of the tree. The beetle succeeds when a weakened tree is unable to push enough pitch through the hole at adequate volume or pressure to pitch out the beetle. Additional evidence of a successful invasion is the presence of debris on or at the base of the tree. The debris is a combination of beetle feces and boring dust.



White pitch tubes indicate a repelled attack, reddish-brown pitch tubes indicate a successful beetle attack
 Beetle debris at the base of an infected pine
 From top to bottom: bark beetle, white pitch tube, fresh pitch, and beetle debris

When bark beetles successfully bore into the tree and create galleries between the [inner bark](#) and sapwood they disrupt the flow of fluids through the [phloem](#) of the tree. As the beetles and larva feed on the fluids and phloem, the flow to the areas above the point of invasion is reduced. A limited number of these disruptions does minimal harm to the tree. The use of [aggregating pheromones](#) by bark beetles to attract more beetles to a single tree results in huge numbers of beetles which overwhelm a healthy tree's defenses. Under normal conditions beetles invade single vulnerable trees within a forest, killing isolated trees. The current outbreak and population explosion of bark beetles has caused large scale invasions on most or all of the mature trees within a patch of forest. The aggregating pheromones attract so many beetles that even healthy trees sometimes succumb to the invasion. These large scale invasions disrupt the flow of nutrients throughout the tree and reduce fluid volume so much that it leads to the eventual death of the tree. The bark beetles also carry a variety of fungi species which lead to [secondary impacts](#) which may shorten the time it takes the tree to die.



Outer bark showing entrance/exit holes made by adult bark beetles
 Galleries bored into inner bark packed with boring dust
 Galleries bored into sapwood. Larger galleries are bored by adults, smaller darker galleries are bored by larvae

There are two different patterns of tree death for bark beetle killed conifers. The first pattern is quite distinctive. The top of the tree dies first as the upper portions of the crown literally starve from lack of nutrients transported through the phloem. The lower portion of the tree is still green and appears to be healthy. The tree continues to die from the top down the trunk until the entire tree

is dead. The second pattern is less obvious. The invaded tree appears green and healthy and then suddenly fades and dies over a relatively short period of time. An otherwise healthy tree can die within a few months to more than a year after the initial bark beetle invasion.



The progression of pine crown death as a result of bark beetle invasion



Tree green and apparently healthy, August 21, 2003

Tree faded and dying, October 1, 2003

[San Bernardino County Museum](http://www.sbcounty.gov/museum)