After the Fire: Bark Beetle Management

Querencia in Action: Landowner Guide

Bark beetles are a native decay agent found in many southwestern forests. Bark beetles typically attack weakened trees when their defenses are poor. Although destructive, the appetite of bark beetles naturally increases the diversity of tree age and tree size across the forest. After a major wildfire disturbance or drought, however, populations can swell and attack healthy trees. This document lays out bark beetle biology and life cycle, identification and assessment of colonized trees, and management strategies.

Biology and Life Cycle

Bark beetles are mostly within the genera *Ips* or *Dendroctonus*. Measuring around 1/3 inch in size or less (Figure 1), bark beetles not only provide a food source for other insects and animals, they also create habitat for many cavity nesting birds and bats. Their name reflects the living and feeding space between the bark and the wood where eventually they girdle their host. Several other non-bark beetle insects flock to recently burned forests for new food and habitat resources. These include longhorned and metallic woodboring beetles (often heard munching loudly in trees) as well as wood wasps. Woodborers and wood wasps are identified by their different body type and sometimes different exit holes (Figure 2). They are only found in highly stressed trees or dead wood. Although they pose a problem for commercial wood value, woodborers and wood wasps rarely threaten healthy trees and are therefore not a concern.

Figure 1. Left photo: Bark beetle on tip of finger (City of Prescott, Az, 2021). https://www.prescott-az.gov/wp-content/uploads/2021/05/1_Ojou-dIYRF_2_WOqduUGpA.jpeg

Right photo: Actual size of a bark beetle in a tree. Photo by Victor Lucero.

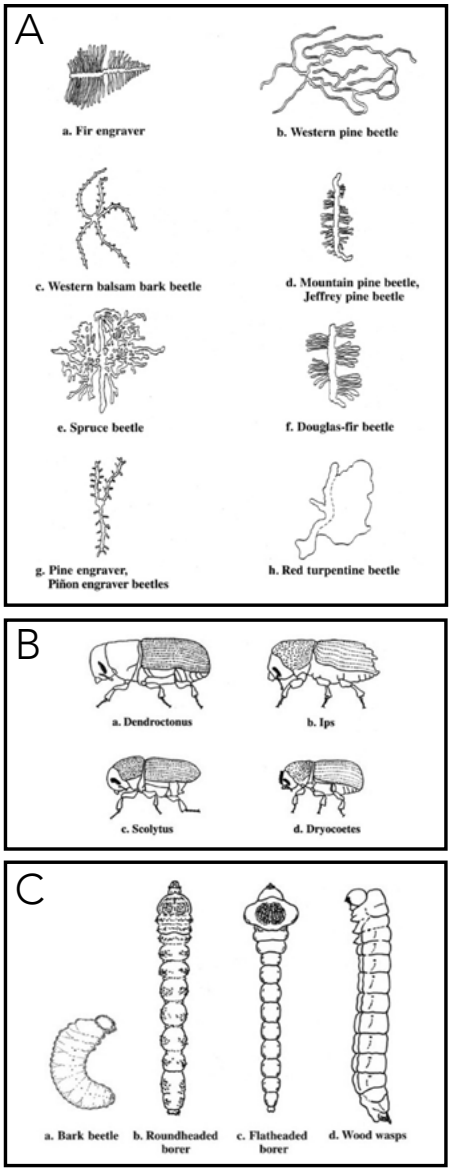

Figure 2. (A) Bark beetle gallery patterns, (B) Adult bark beetles, and (C) Bark beetle larvae compared to woodborer larvae (USFS, 2013). https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5186641.pdf (pg. 13-14)

The bark beetle's life cycle can range from multiple per year to two years (Figure 3). Adult beetles fly to a host and chew to the phloem. The tree often reacts by creating pitch that looks like a gooey tube exuding from the entrance hole (Fig 4). When a tree is successfully attacked, bark beetle eggs are laid in the fresh phloem creating an egg gallery. The eggs hatch into larvae (small, white grubs with distinct heads and no legs) that feed away at right angles from the gallery creating outward tunnels where the pupae typically overwinter. Each species has a characteristic pattern of egg galleries and larval mines that are easily identified in field guides (see Fig 2. and References). Simultaneously, bark beetles are hosts to blue stain fungi and carry fungal spores on its body, that can infect the tree's cambium. The spores germinate and the fungus disrupts water transport in the xylem. This disruption plus the feeding activity of the bark beetle,

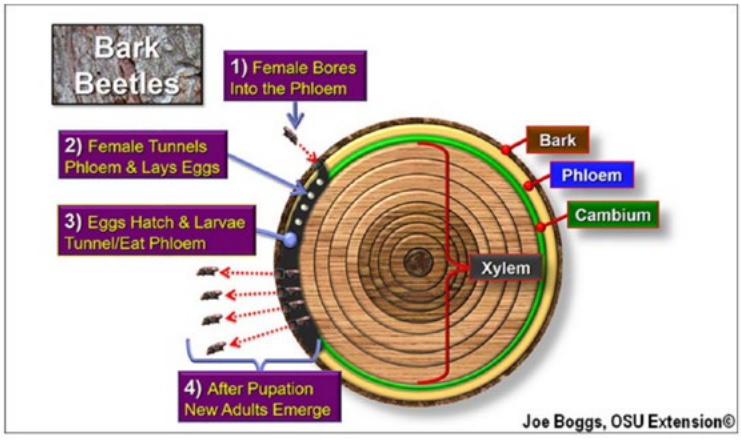

Figure 3. Life cycle of bark beetle (Boggs, 2023). https://bygl.osu.edu/node/1666

accelerates the death of the tree. In the spring, the adult beetle emerges from its host, often puncturing the bark with BB like holes, and seeks new trees in which to lay their eggs. Bark beetle species often have preferred tree hosts and diameter sizes.

Identification and Assessment

To understand how a tree stand is impacted and what actions to take, it is important to identify if the attack on your tree was caused by a bark beetle or another insect or disease. Asking questions and referring to the USFS's Field Guide to Insects and Diseases of Arizona and New Mexico Forests help to narrow down the culprit.

If you find many of these symptoms or signs, likely your trees have been attacked by bark beetles. The surest clue is the identification of the galleries beneath the bark using the USFS's Field Guide.

Figure 4. Pitch tubes created by trees defending themselves from bark beetles (Photo (left) by Bob Oakes, USDA Forest Service, Bugwood.org. Photo (right) Characteristic wedge-shaped blue stain pattern in a bark beetle / blue stain killed ponderosa in Montezuma, NM in Dec. 2023. Right photo by Victor Lucero.

https://www.uidaho.edu/-/media/UIdaho-Responsive/Files/Extension/topic/forestry/ID26-Everything-you-wanted-to-know-about-bark-beetles.pdf

Questions to Help Identify Insect:

- Has there been disturbance recently (windthrow, fire, etc.)?
- Are there fading crowns (faded green, yellow, red, or brown)?
- Are there groups of dead or dying trees? Are they the same or closely related species? Similar range of diameter sizes? Showing symptoms at the same time?
- Is there reddish or brownish boring dust (base of tree or in bark crevices)?
- Are there pitch tubes on pines, white fir, and spruce trunks? (Doug-fir does not produce pitch tubes, however boring dust will be visible) (Figure 4).
- Are there BB sized emergence holes?
- When peeling back the bark, are there galleries? What do the gallery patterns look like?
- Are there live beetles?

Management Strategies

Areas that have experienced moderately severe burns are at greatest risk of succumbing to bark beetles. Management strategies include monitoring, suppression, and prevention. Monitoring fire-stressed/scorched trees within and immediately outside fire perimeter for two years is important as bark beetles can spread from weakened trees to healthy trees. Fire-stressed/scorched ponderosa pine and Douglas-fir are commonly attacked by bark beetles within and immediately outside fire perimeter. Watch for indications, as described above, of increasing bark beetle activity.

According to Dr. John Formby, forest entomologist with New Mexico ArborPro, some trees with 80-90% scorched canopy can actually survive after a fire. Although, this number is dependent on tree species (see "Forest Thinning: What to Do with Burned Trees: Querencia in Action: Landowner Guide"). You can cut burned trees, but many fire-scorched trees can survive given time. Some trees may eventually succumb to fire stress or bark beetle infestation. These trees should be removed along with any hazard trees. In forests where there is a Douglas-fir or spruce component, MCH (3-methylcyclohex-2-en-1-one) can be used to prevent bark beetle attacks. MCH is an anti-aggregation pheromone used by Doug-fir and spruce beetles that is like posting a "no vacancy" sign on the tree. MCH is safe to use with little impact on the environment.

If trees are found being actively attacked (live bark beetles observed), promptly fell and remove the trees from the property. There is a danger in storing felled wood for firewood as bark beetle populations can continue to build up on the property and infest nearby trees.

Although not an immediate response to infestations, prevention is a highly effective strategy to curb future infestations. Research shows that stands with higher tree density and trees with lower growth rate are more likely to have higher mortality from bark beetle populations. Active forest management, such as prescribed fire and thinning, can be used to decrease basal area, tree density, host species composition, susceptible age classes, and competition. These management activities also alter bark beetles' perceptions by changing air temperature and light exposure and hindering their location of host trees. **It is recommended to thin when beetles are inactive from October to February and not to leave large diameter trees on the ground longer than 30 days.** As a general rule, bark beetles begin to emerge in the Spring when daytime temperatures average 50 degrees or more for at least a week. Beetles go dormant in the Fall when overnight temperatures fall below 40 degrees for two consecutive weeks. Chemical treatments are available but not described in this document.

Bark beetles are a natural component to forest decomposition. However, fire can cause an opportunity for bark beetles to increase their numbers and attack healthy trees. Identifying beetles and assessing colonization and tree susceptibility can support land managers in making appropriate decisions for their forests. The number one defense method for bark beetles, however, is preventative care of the forest by strategic thinning and controlled burns.

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