

Spruce Beetle (*Dendroctonus rufipennis*)

Distribution and Hosts

Spruce beetle occurs in the West from Alaska to Arizona and throughout Canada east to the Maritime Provinces and northeastern United States. This species feeds on all native spruces within its range. In Idaho, Engelmann spruce is the favored host; Colorado blue spruce is rarely attacked.

Life Cycle

In higher elevations spruce beetle may require two years to complete its life cycle (semivoltine), but a one-year life cycle (univoltine) is common at lower elevations. In Idaho, both one and two-year development occur, sometimes in the same location. Adult beetles (**Figure 1**) start flying in early summer to locate and colonize new host trees. Attacking beetles produce aggregation pheromones that attract additional beetles to mass-attack trees, which helps the beetles overwhelm tree defenses. In successful attacks, adult beetles bore through the bark, mate, and females lay eggs in vertical galleries constructed in the inner bark (**Figure 2**). After egg hatch, larvae may feed in a group for the first two molts, then the older larvae make individual galleries. In a one year life cycle, winter is spent in the adult stage and they emerge the following summer. In a two-year life-cycle the first winter is spent as a larva and the second winter as an adult. In both life cycles, adults must overwinter before emerging the following year.



Figure 1. Spruce beetle adult.



Figure 2. Spruce beetle galleries and developing larvae beneath the bark. *Photo J. King.*



Figure 3. Boring dust (frass) and fallen needles at base of tree



Figure 4. Typical spruce beetle pitch tube.

Damage

Spruce beetle populations often build in fallen trees and then move into standing timber. Large diameter trees are preferred, though small trees can be killed when the larger ones are depleted. Larval feeding in the inner bark interrupts water and nutrient transport and girdles the tree. Beetles also introduce mutualistic stain fungi which hastens host tree mortality by obstructing the flow of water, resin and other resources in the sapwood. Sapwood decay fungi are introduced as well, resulting in volume loss over time after the tree has been killed. Spruce beetle can be very aggressive under favorable conditions, killing many large spruce in a year or two. The most recent large-scale outbreaks in Idaho occurred north of Elk City from 2016-2019 and in the McCall area of central Idaho in the 1990s. Alaska, Utah, and Colorado have experienced large scale outbreaks in the recent past.

Recognition

Signs of spruce beetle attack include reddish boring dust (frass) in bark crevices and around the base of the tree (**Figure 3**), and pitch tubes where defensive resin is produced at attack sites (**Figure 4**). Vertical galleries (**Figure 2**) that are packed with frass can be found beneath the bark of attacked trees. Needles fade from green to yellow the season after attack and frequently fall and accumulate at the base of the tree (**Figure 3**). Woodpeckers often remove bark that flakes off and builds up at the base of the tree. Such trees are easy to identify at a distance and in winter.

Spruce Beetle Management

Identify Hazard Dense stands with large diameter trees and those with a high proportion of Engelmann spruce are most susceptible to spruce beetle. Spruce beetle outbreaks often start when a winter storm, avalanche, or other weather event results in uprooted green trees. Outbreaks can also start in logging debris left onsite during management activities.

Silviculture Thinning high-hazard stands to increase tree spacing and decrease tree size reduces susceptibility to spruce beetle. Basal area (BA) is a measure of stand density and is the cumulative area (in ft²) of the cross section of all trees in an acre of forest (at 4.5 ft above the ground). Thinning stands to BAs <100 ft²/acre, reducing the proportion of spruce in a stand below 50%, and reducing the average diameter of spruce can reduce stand susceptibility. Creating multiple age and size classes of trees can also reduce losses by limiting the number of susceptible, large-diameter hosts on the landscape at a given time. Trap trees (trees cut unlimbed and left in the shade), or log decks made during the flight period are very effective in containing beetles which are then removed from the site. It is very important that all trap trees and decks are removed before snowfall and not left in the woods (**Figure 5**). Since spruce beetle will infest stumps, they should be cut as short as practical (<18"). Every effort should be made to minimize excess logging residuals (cull logs and tops >4" diameter) and burn slash to reduce breeding sites (**Figure 6**). It is important to remember that beetles will only be in green slash, not wood that is two or more years old.

Sanitation & Salvage Spruce beetle problems often originate in green blowdown or cut trees. If damage occurs in a managed stand, every effort should be made to salvage trees damaged over the winter (**Figure 7**). Currently infested trees can be identified by frass on the bark or around the base of the tree (**Figure 3**), or pitch tubes on the bark (**Figure 4**). Infested trees should be removed when practical, especially before snow makes access difficult.

Insecticides Several insecticidal bark sprays are labeled for spruce beetle and can provide short-term protection for individual, high-value trees. Such sprays are too expensive and impractical to use for entire stands. Bark sprays must be applied preventatively and will not kill beetles already inside the tree. Preventive sprays should cover the entire bark up to a 6" diameter top. Protection of taller trees may be challenging due to low branches covering the trunk and sprayer limitations. The use of insecticides is prohibited in some areas such as riparian areas close to water. **Read and follow all insecticide label directions.** Forest health professionals can assist in determining an appropriate and effective treatment plan.

Anti-aggregation Pheromones Like most bark beetles, spruce beetle communicates with pheromones, chemical signals derived from host compounds. Methylcyclohexeneone (MCH), an antiaggregation pheromone commonly used for Douglas-fir beetle also includes spruce beetle on the label. Effectiveness has been inconsistent, and MCH use is not recommended for spruce beetle at this time. Researchers are working on adding other chemicals to enhance the effectiveness to prevent spruce beetle attacks. *Seek advice from a forest entomologist or consulting forester when considering spruce beetle management with MCH.*

For more information:

US Forest Service Management Guide: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5187555.pdf

US Forest Service Forest Insect & Disease Leaflet: <https://www.fs.usda.gov/foresthealth/docs/fidls/FIDL-127-SpruceBeetle.pdf>

IDL Forest Health web page: <https://www.idl.idaho.gov/forestry/insects-and-disease>



Figure 5. Photo A shows tree cut in forest right-of-way in fall. Photo B shows spruce beetle galleries in the same tree the following summer.

Photos: J. King



Figure 6. Burning logging residuals to reduce spruce beetle risk. Photo USFS R2 bug-wood.org.



Figure 7. Wind thrown spruce. Salvaging should be a high priority in managed forests. Photo K. Gibson.