Managing pine bark beetle damage in Minnesota’s forests
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Pine bark beetles, including the pine engraver species *Ips pini* and *Ips grandicollis* (Fig. 1) are responsible for killing many pine trees in Minnesota. Minnesota’s red pines are a commercially and ecologically important species throughout the state. Pine engraver beetles are commonly associated with pole-sized (21 to 50 years) and mature red pine forests (>50 years).

According to Minnesota Department of Natural Resources annual reports, bark beetles impacted 4,891 and 3,150 acres of pine forests in the state in 2014 and 2015, respectively. Actual acreage is difficult to determine since bark beetle activity occurs in variable-sized pockets, but outbreaks are commonly observed during drought years (Table 1). Beetles develop tunnels beneath the bark which reduces the flow of water in the tree, ultimately contributing to death in an unhealthy tree.

Table 1: Notable bark beetle outbreaks associated with drought years in Minnesota.

<table>
<thead>
<tr>
<th>DROUGHT YEAR(S)</th>
<th>NOTES FROM MN DEPARTMENT OF NATURAL RESOURCES FOREST HEALTH ANNUAL REPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976-1977</td>
<td>On sandy soils, conifers of all ages died or were weakened to the point where bark beetles became a problem.</td>
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<tr>
<td>1987-1988</td>
<td>A large number of bark beetle pockets were initiated in 1987. Four generations of bark beetles were bred in 1988. Eighty percent of all pine plantations in Stearns, Benton, Sherburne, Kanabec, and Anoka counties had active bark beetle pockets in 1988. Weather conditions identified this as a 150-year drought.</td>
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<td>2004-2005</td>
<td>In southeastern counties, a significant amount of bark beetle activity was observed in the early summer of 2004.</td>
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<td>2006-2009</td>
<td>This serious and prolonged drought created stress conditions favorable for bark beetle buildup. Damage from <em>Ips</em> and <em>Dendroctonus</em> bark beetles totaled 3,600 acres in 2009.</td>
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<tr>
<td>2012</td>
<td>Damage from <em>Ips</em> bark beetles totaled 310 acres, but adequate rainfall occurred in the central portion of the state to minimize activity.</td>
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</tbody>
</table>

SYMPTOMS

Life cycle
Bark beetles overwinter in the duff layer beneath trees, emerging as adults in April-May. After boring into bark, adults form galleries beneath the inner bark to lay eggs. Eggs will eventually become adults over the span of several weeks and will bore outside of the bark, forming small BB-sized exit holes. When numerous, this resembles damage from a “shotgun blast” (Fig. 2).
stressed under drought. Trees showing damage from bark beetles are also often subject to additional stressors such as Armillaria root rot.

**Other wood borers**
Wood borer larvae are larger (1-inch or more in length), while bark beetle larvae are 3/16th-inches long. Wood borers are not a threat to living pines.

Mountain pine beetle (*Dendroctonus ponderosae*) is a western bark beetle species but has not been found in Minnesota’s forest as of 2018. The state implemented an exterior quarantine in 2015 that prohibits the movement of pine wood with bark into Minnesota from states with mountain pine beetle.

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**Fig. 2. Exit holes from pine engraver beetle appear as “shotgun blasts” as a new generation of bark beetles chew their way out of the bark. (photo: Steve Katovich)**

A first generation of adults emerge in June, and a second in August. Depending on conditions, a third generation can develop within the same year.

**Tree symptoms and vulnerability**
Bark beetles attack standing pines, freshly-cut pine logs, and slash left on the forest floor. On standing pines, needle color often turns yellow and appears reddish-brown by the late summer (Fig. 3). Outbreaks often occur in small pockets of three to five trees. The stem and branches can be inspected for beetle presence by (1) examining sawdust-like boring material near holes and (2) removing a portion of the bark over the holes to check for beetle larvae and their galleries.

Red pines are particularly vulnerable to bark beetles that take advantage of their weakened state during drought years. Pines can overcome bark beetle attack by producing pitch, but pitch cannot be produced in sufficient quantities when

**Fig. 3. Discoloration of foliage on attacked red pine trees from bark beetles. (photo: Steve Katovich)**
**Disease look-alikes**

Diplodia is a widespread disease across Minnesota that causes shoot blight. Needles will turn straw colored on pines which may mimic symptoms of bark beetle damage. Tiny, black spores found at the base of dead needles, on cone scales, and/or on twigs and branch bark can confirm Diplodia.

**MANAGEMENT STRATEGIES**

Red pine is managed for various goals and objectives across Minnesota ranging from timber production to wildlife habitat. This creates a wide variation in forest structure and composition with some forests receiving several forest management treatments and others more natural. Red pine forests where the primary goal is the production of high quality saw logs are generally managed in even-aged plantations. In general, forest management that emphasizes long-term strategies that sustain tree vigor can prevent or minimize the risk of beetle outbreaks.

**Thinning**

Thinning is one tool that reduces competition and lowers the likelihood of bark beetle outbreaks. In particular, red pine responds robustly to various thinning regimes and intensities. The type and intensity of thinning will depend on the site and stand conditions. The Revised Managers Handbook for Red Pine in the North Central Region, published by the USDA Forest Service in 2006, provides a number of management recommendations for site conditions.

Proactive treatments are the best strategy for increasing resistance to bark beetles. Consider timing thinning and other forestry operations to occur during the fall and winter months when bark beetles are not active. Thinning should not occur during a drought and for one year following a drought. Drought conditions may also hinder successful tree regeneration following forest management treatments.

According to the Minnesota Department of Natural Resources (MN DNR), if thinning or cutting occurs in the winter or early spring, logs and slash should be removed before June 1. If thinning or cutting occurs in the summer, logs and slash should be removed within three weeks of when the thinning or cutting occurred (Table 2). Woody debris greater than 3 inches in diameter should be removed or destroyed. The MN DNR updated these guidelines in 2015 by allowing timber sale administrators to allow or stop harvesting operations on state lands to minimize damage from beetle infestations. Operators should avoid wounding trees during thinning and harvesting operations.

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### Table 2: Minnesota Department of Natural Resources guidelines to minimize bark beetle damage during pine thinning operations in Minnesota.

<table>
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<th>TIME OF YEAR</th>
<th>NOTES FROM MN DEPARTMENT OF NATURAL RESOURCES FOREST HEALTH ANNUAL REPORTS</th>
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<tr>
<td>December 1 through May 31</td>
<td>Haul or destroy cut pine greater than 3 inches in diameter by June 1.</td>
</tr>
<tr>
<td>June 1 through August 31</td>
<td>Haul or destroy cut pine greater than 3 inches in diameter within three weeks.</td>
</tr>
<tr>
<td>September 1 through November 31</td>
<td>No special restrictions for pine cut in this period.</td>
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</table>

**Yard trees**

If freshly cut conifer firewood or woody debris from conifer species is lying near healthy pines, move the wood away from the trees. Debris can be moved to an approved wood waste disposal site or chipped. Water trees during times with low rainfall and continue to monitor their health.
SUMMARY

- Bark beetles are commonly associated with pole-sized and mature red pine forests.
- Proactive forest management and tree care techniques can be taken to mitigate losses in pines from bark beetles.
- Forestry professionals should be consulted to determine the appropriate time of year to conduct thinning operations to minimize bark beetle damage.

ADDITIONAL RESOURCES


Minnesota Department of Natural Resources. Pine bark beetles (Ips species). Available at: http://dnr.state.mn.us/treecare/forest_health/barkbeetles/index.html

Red pine management guide: a handbook to red pine management in the North Central region. Available at: https://www.nrs.fs.fed.us/fmg/nfmg/rp/docs/rp_all.pdf

What’s wrong with my plant? Evergreens (University of Minnesota Extension): http://www.extension.umn.edu/garden/diagnose/plant/evergreen/

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This publication was reviewed by Steve Katovitch (US Forest Service) and Marcella Windmuller-Campione (UMN Dept. of Forest Resources).