



Solarization of firewood

the cut or prune during fall or early winter. This will allow time for cuttings to dry appropriately without attracting bark beetles. Removal of the debris from the site will also help in reducing the attraction of bark beetles.

If removal of infested trees is not an immediate option, it is recommended that cuttings be stacked in piles no larger than a cord and covered with heavy (6 ml) clear plastic in sunny areas for several weeks. This solarization process will heat the wood to a level that will kill any remaining beetles. Vigilance is necessary, as tears in the plastic must be patched and edges must be securely buried.

Disease exposes trees to twig and bark beetle attacks. Removing diseased trees can help control the spread of the disease and the beetles.

In residential yards, avoid planting high water-use vegetation (grass and shrubs) near trees to reduce competition directly with the tree. Create a buffer zone around trees using mulch that is less than 3" thick to help retain moisture. Do not increase the depth the mulch next to the base of the tree.

*It is in violation of the law to use insecticides inconsistent with label instructions.



Piñon mortality

Keep physical damage to trees at a minimum. Do not dig trenches near a tree where roots can be damaged. Remember that roots grow 2 to 3 times the width of the crown. Minimize road or lot grade changes to protect the roots. Do not lay asphalt close to tree trunks or over root systems.

Insecticides* are also available. These are not economical for large stands but could help protect valuable trees near the home. Carbaryl or permethrin are chemicals that, when applied to the bark, provide a protective residual barrier. However, no treatment is 100% effective in every application. Remember, if bark beetles are already in the tree, the spray will not help and the tree will die. Systemic insecticides have not proven to be effective against *Ips* bark beetles.

Photographs courtesy of the USDA Forest Service and the author.

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Facts on the Piñon Ips

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What's happening to the Piñon trees?

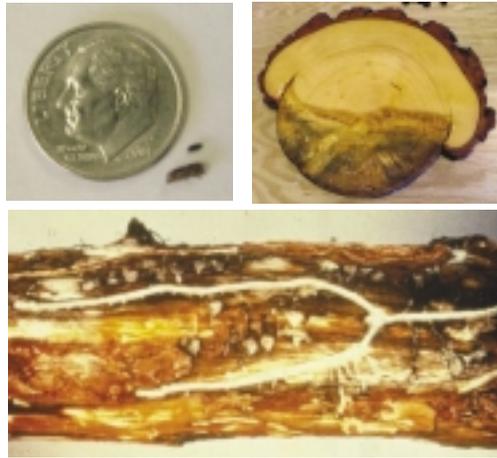
Piñon pine and juniper trees cover approximately 9 million acres of land in New Mexico. Currently more than 800,000 acres of piñon pine are dead or dying. What is causing this mortality?

The piñon die-off is caused by several different factors. Years of above-average rainfall allowed the piñon to grow more densely and flourish in areas it historically did not. The combination of over-dense stands and current drought has caused the piñon to become stressed. Stress in trees creates prime conditions for insect attack and disease.

In New Mexico, bark beetles (*Ips confusus*) and twig beetles (*Pityophthorus* spp., and *Pityogenes* spp.) have attacked thousands of acres of host trees, reducing the amount of piñon pine. The main differences among *Ips*, *Pityophthorus*, and *Pityogenes* is the part of the tree they attack. *Ips confusus* attacks the bole, or trunk, of the tree and branches 3" or more in diameter.

Pityophthorus and *Pityogenes* will attack branches and portions of the trunk that have thin bark and are less than 3" in diameter. Twig beetles can be controlled by pruning infested branches, *Ips* attacks the bole of a tree.

The Piñon *Ips* is a native insect to the area ranging from British Columbia to Mexico, west to California and east to western Texas. These tiny beetles are 3.5-4.2 mm long, the size of an uncooked grain of rice. Their coloring is dark, usually reddish to dark brown.



(Top left) *Ips confusus* vs. twig beetle. *Ips* is larger.
(Top right) Blue stain fungus (Bottom) Galleries

They are a natural component of the ecosystem and maintain small populations in slash and/or scattered areas of damaged or stressed piñon trees, acting as a thinning agent. In addition to drought, trees can become stressed by wind, snow, lightning and fire. During periods of drought outbreaks occur over large landscapes. Historically, outbreaks in the Southwest have been short lived, usually lasting 3 to 7 years. Trees killed by beetle infestation still serve a purpose, providing shelter for understory vegetation or as wildlife habitat.

Life Cycle

The piñon *Ips* generally has two to three generations per year and may have more in warm climates. In the spring, adults emerge from under the bark and fly to a suitable host. The males act as a pioneering beetle, boring into the host tree and releasing a pheromone to attract multiple females. This pheromone is referred to as an aggregation pheromone. This pheromone is not only used to attract a mate, but also creates a

mass attack on the host to overcome the tree's natural defense.

The male beetle usually mates with three to four female beetles in a single nuptial chamber. The female then tunnels a gallery, going with the grain of the wood, laying eggs on each side as she moves. This behavior creates 'Y' or 'H' shaped markings in the wood under the bark. Once the tree is full, an anti-aggregation pheromone is released to deter other beetles. Under the bark, these insects transition from egg to larva to pupa to adults as they feed, moving away from each other. This process takes approximately six to 10 weeks. They over winter under the bark at the base of the tree when average daytime temperature drops below 60°F. During the aggregating process, the bark beetle kills the tree by girdling it with its galleries. It also carries with it a blue stain fungus that blocks the water-conducting pathways and leaves the marking of a blue discoloration within the wood.

Evidence

Evidence of bark beetle infestation varies. Tree needles will fade from green to yellow and then reddish-brown. To detect the beetle before this point, look for small, inconspicuous signs such as fine saw dust in bark crevices and at the base of the tree. This dust is created from the bark beetle boring into a tree. There will also be evidence of small openings where the beetle tried to bore in and pitch oozed out, "pitching out" some of the attacking beetles. These pitch tubes are pink in color.

Prevention

While there are accepted methods of prevention for the bark beetle, it is important to remember that once a tree is infested, it



Boring dust

cannot be saved. Early prevention is the best way to protect or reduce the chance of tree loss to twig and bark beetles. Most healthy trees are usually capable of fending off invaders through resin or sap flow. However, stressed trees often do not have the ability to produce enough sap to pitch out attacking insects. Tree stress may be caused by insufficient moisture, soil compaction (including root damage), disease, overcrowding or physical damage.

During periods of drought, trees compete for water with each other and other vegetation, further increasing already high stress levels. Reducing the number of trees on a per-acre basis will free up water and allow trees to build up their natural defenses. Most drought-tolerant trees (i.e. piñon, juniper, ponderosa pine) are adapted to more open stands. The best way to help a tree defend itself is to provide it with water consistently.

If you live in an area where tree cutting or pruning is necessary, schedule