

CMG GardenNotes #110

Homework: Ips and Mountain Pine Beetles

1. IPB Beetles

Reference: CSU Extension Fact Sheet
#5.558, *Ips Beetles*

- a. What trees are at risk? Why are newly planted trees at risk?
- b. What two factors have contributed to the current outbreak in Ips beetles in Colorado?
- c. What are the general symptoms of Ips beetles?
- d. How can you tell if the beetles have moved on (to another part of the tree or other trees)?
- e. What does the presence of woodpeckers indicate? What are the symptoms of woodpecker feeding?
- f. To reduce Ips beetles, how should “slash” from pruning and thinning practices be treated?
- g. When will Ips beetles adults fly?
- h. Why would a preventively-sprayed tree later die from beetle attack?
- i. What is the rule of thumb for considering if a tree is at risk and should have a preventative spray?

Ips Beetles

Fact Sheet No. 5.558

Insect Series | Trees and Shrubs



by W. Cranshaw and D.A. Leatherman*

Ips beetles, sometimes known as “engraver beetles,” are bark beetles that damage pine and spruce trees. They develop under the bark and produce girdling tunnels that can cause dieback and kill trees. Eleven species of ips beetles occur in Colorado (see Table 1).

Ips beetles are generally not considered as destructive or aggressive as bark beetles in the genus *Dendroctonus* (mountain pine beetle, spruce beetle, Douglas-fir beetle). Normally ips beetles limit their attacks to trees that are in decline due to root injuries, wounding, or other stresses. However, under widespread conditions which allow improved survival and large population build-ups, ips beetles are a considerable threat to living trees. Two factors that recently contributed to ips beetle problems in Colorado include: prolonged drought stress; and the creation of freshly-cut wood (which is a preferred breeding site) from forest homeowner efforts to reduce wildfire hazards.

Ips beetles are small (1/8 to 3/8 inch long), reddish-brown to black beetles. They have a pronounced cavity at the rear end, which is lined with three to six pairs of tooth-like spines, depending on the species. The latter feature distinguishes them from other bark beetles (see Figure 1).

Symptoms of Ips Beetle Injury

As adult ips beetles enter trees and tunnel, a yellowish- or reddish-brown boring dust is produced and accumulates in bark crevices or around the base of the tree. When the larval tunnel, affected parts of the tree discolor (“fade”) and die. These symptoms may be limited to parts of the tree, such as a single branch or the top. However unlike mountain

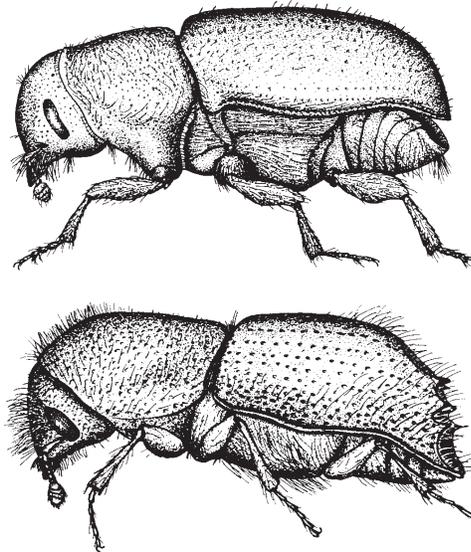


Figure 1: Adult *Dendroctonus* (top) versus *Ips* (bottom). Note gradually curved wing of *Dendroctonus*. Actual size of *Dendroctonus* from 1/8 to 1/3 inch, *Ips* 1/8 to 3/8 inch.

pine beetle, infestation by ips beetles does not necessarily mean the whole tree will die, but over time, attacks may progress as later generations “fill” the tree and then ultimately the host can die.

Small round holes in the bark of infested trees indicate the beetles have completed development in that part of the tree and the adults have exited. The presence of these holes peppering the bark show the beetles have moved to another part of the same tree or to neighboring trees.

Woodpeckers are common predators of ips beetles. Their presence may also indicate bark beetle activity. Woodpeckers often remove the tree bark in an effort to obtain this food source. This habit results in ragged holes or patches of missing bark on the tree.

Generalized Life History

Adults overwinter under the bark or in surrounding litter at the tree base. They begin to attack weakened trees in the spring. Initially the male enters the tree, constructs a

Quick Facts

- Ips is a common group of bark beetles that infests pine and spruce trees.
- Ips beetles rarely attack healthy trees. Most problems with ips occur to newly transplanted pines or when plants are under stress.
- Several generations of ips can occur in a season.
- There are 11 species of ips beetles found in Colorado.

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Table 1. Common ips beetles (*Ips* species) affecting pines and spruce in Colorado.

Species	Hosts	Comments
<i>Ips hunteri</i>	Spruce	This is a common species affecting Colorado blue spruce in landscape settings. Upper portions of the tree are typically infested first.
<i>Ips pilifrons</i>	Spruce	A forest species often called the “spruce ips”; tends to infest the upper part of fallen trunks.
<i>Ips pini</i>	Ponderosa, lodgepole	The most common species associated with other pines in Colorado.
<i>Ips knausi</i>	Ponderosa pine	Common at base of trunk and in fresh stumps.
<i>Ips calligraphus</i>	Ponderosa pine	Largest ips species in Colorado; often in main trunk.
<i>Ips confusus</i>	Piñon, rarely other pines	Periodically kills piñons over large areas.
<i>Ips latidens</i>	3- and 5-needled pines	
<i>Ips borealis</i>	Engelmann spruce	
<i>Ips integer</i>	Primarily Ponderosa pine	
<i>Ips woodi</i>	Limber pine	
<i>Ips mexicanus</i>	Lodgepole and limber pines	

cavity under the bark known as the “nuptial chamber.” Females are attracted to the tree by chemicals (pheromones) produced by the male.

After mating, females (usually three) excavate egg galleries off the central chamber. The tunnels produced by the adults appear as a “Y”- or “H”- shaped pattern. These galleries are mostly free of boring dust, which is pushed out of the entrance hole as the adult beetles work. These “cleared out” galleries have a different appearance than the debris-filled galleries of *Dendroctonus*. Eggs are laid along the gallery and young larvae soon hatch and begin tunneling smaller lateral galleries that lightly etch the sapwood. They are small grubs, about 1/4 inch long when mature, white to dirty gray, legless, with dark heads. In Colorado, two to four generations of these beetles usually develop per year.

Management

To prevent ips beetle attacks, use practices that promote vigorous tree growth. Properly siting trees in landscape plantings is important to allow optimal growing conditions as the tree matures. Adequate – but not excessive – water may be needed. Root injuries caused by mechanical damage, compaction, or disease should be avoided.

Freshly-cut material that results from pruning or thinning practices (called “slash”) should be removed from the vicinity of valuable trees. Never stack

green or infested coniferous wood next to living coniferous trees. Such green woody material should be chipped or treated so that the inner bark area is destroyed. Ips larvae will not survive standard chipping or debarking treatments. Other treatments could include scattering (as opposed to piling) slash to promote rapid drying.

Trees at risk of ips attack include newly transplanted trees, trees suffering root injuries from construction, and trees surrounded by large breeding populations of ips beetles. These types of trees can benefit from preventive insecticide applications.

Insecticides are used as drenching preventive sprays on the trunks and larger branches. These insecticides need to be applied prior to adult beetle infestation. (Remember that overwintering beetles begin emerging in spring as soon as daytime temperatures consistently reach 50 F to 60 F.) However, timing can be difficult to determine since ips beetles can have multiple, overlapping generations and life cycles. Adults have been observed entering trees during warm days as early as late-February on through November. Because of this extended activity, two treatments (early spring and summer) may be needed to protect trees during high-risk conditions.

Insecticides used to prevent ips include either permethrin, bifenthrin, or carbaryl (Sevin) as the active ingredient. There are many products currently on the market containing these active ingredients. Follow

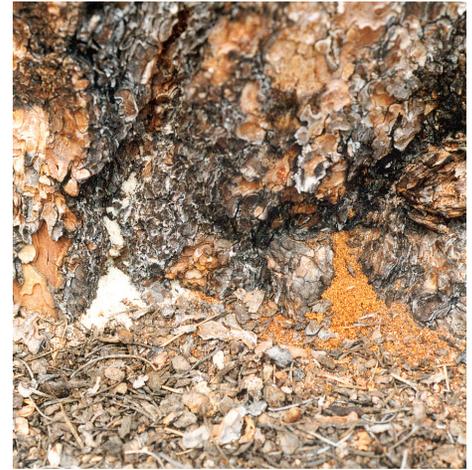


Figure 2: Boring dust at the base of a pine tree. Reddish boring dust is caused by ips beetles. The whitish dust is from ambrosia bark beetles.



Figure 3: Tunneling by *Ips hunteri* in blue spruce.



Figure 4: Top dieback of spruce from drought stress and ips attack.



Figure 5: Storing cut firewood near susceptible trees greatly increases the risk of ips beetle attack.



Figure 6: *Ips confusus* pitch tubes on infested pinyon pine trunk.

the manufacturer's recommendation for the proper rate for bark beetle treatment. Bark beetle applications at the labeled rate should provide at least three months control of ips beetles.

When a preventively-sprayed tree later dies of beetle attack, it is usually for one of the following reasons: 1) the tree was sprayed after it was attacked; 2) the spray was applied at too dilute a rate; 3) the entire bark surface of the susceptible part of the tree was not sprayed; or 4) the material wore off and was no longer effective.

Insecticide applications are not needed when ips beetles do not pose a serious risk to healthy trees. Ips problems are often an issue for a few years, then lessen naturally to non-threatening levels. This is the normal condition in Colorado. A rule of thumb when deciding if preventive treatments are needed is to survey for infested groups of bark beetle-killed trees (as determined by dead foliage) within sight of the live trees in question. Also, transplants or recently disturbed trees in natural forest areas or near other known sources of ips may warrant protection. Tree value, of course, is always a consideration. There is often more interest in protecting high-value trees such as those around residences, golf courses, or in other highly visible settings.

No chemical treatment exists for trees or wood already infested by ips beetles. In rare cases where it is feasible to reduce the threat to live trees by killing beetles within infested trees before they exit, treatments involve bark removal, chipping the wood into small pieces, covering piles with a double-layer of 6-mil thick clear plastic sealed around the edges with soil to heat (solarize) the wood, or physical removal of infested material from the site to an area a mile or more from susceptible trees.

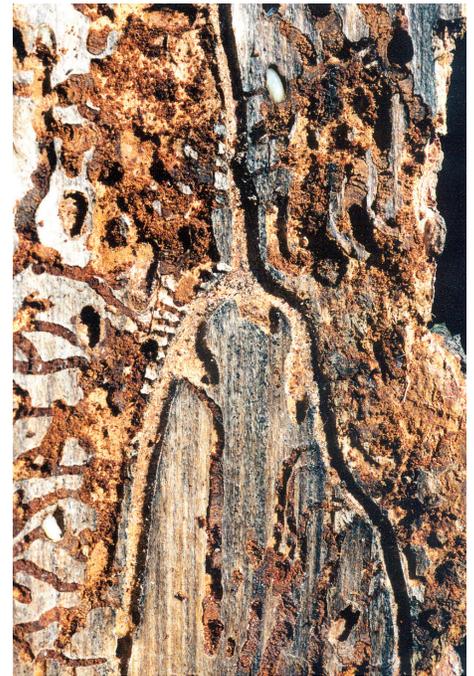


Figure 7: *Ips pini* egg galleries under bark of ponderosa pine trunk.

Note: Concentrations of insecticides used to control bark beetles are often considerably greater than those used for insects on foliage. To avoid needle burning, try to limit the application to the bark, particularly when using liquid (emulsifiable concentrate) formulations that have increased risk of causing plant injuries.

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Mountain Pine Beetle

Fact Sheet No. 5.528

Insect Series | Trees and Shrubs

by D.A. Leatherman, I. Aguayo, and T.M. Mehall*

Mountain pine beetle (MPB), *Dendroctonus ponderosae*, is native to the forests of western North America. Periodic outbreaks of the insect, previously called the Black Hills beetle or Rocky Mountain pine beetle, can result in losses of millions of trees. Outbreaks develop irrespective of property lines, being equally evident in wilderness areas, mountain subdivisions and back yards. Even windbreak or landscape pines many miles from the mountains can succumb to beetles imported in infested firewood.

Mountain pine beetles develop in pines, particularly ponderosa, lodgepole, Scotch and limber pine. Bristlecone and pinyon pine are less commonly attacked. During early stages of an outbreak, attacks are limited largely to trees under stress from injury, poor site conditions, fire damage, overcrowding, root disease or old age. However, as beetle populations increase, MPB attacks may involve most large trees in the outbreak area.

A related insect, the Douglas-fir beetle (*D. pseudotsugae*), occasionally damages Douglas-fir. Most often, outbreaks are associated with previous injury by fire or western spruce budworm. (See fact sheet 5.543, *Western Spruce Budworms*). Spruce beetle (*D. rufipennis*) is a pest of Engelmann and Colorado blue spruce in Colorado. Injured pines also can be attacked by the red turpentine beetle (*D. valens*).

Mountain pine beetles and related bark beetles in the genus *Dendroctonus* can be distinguished from other large bark beetles in pines by the shape of the hind wing cover (Figure 1, top). In side view, it is gradually curved. The wing cover of *Ips* or engraver beetles, another common group of bark beetles attacking conifers, is sharply spined (Figure 1, bottom).

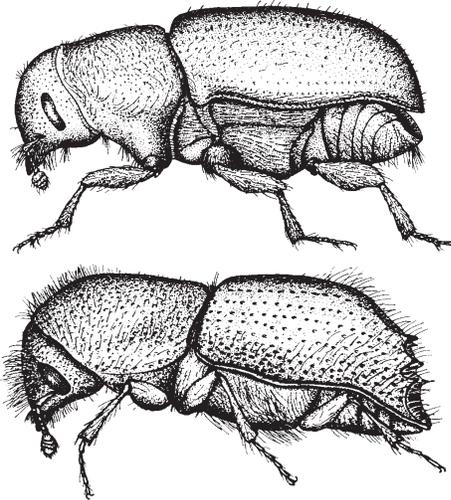


Figure 1: Adult *Dendroctonus* (top) versus *Ips* (bottom). Note gradually curved wing of *Dendroctonus*. Actual size of *Dendroctonus* from 1/8 to 1/3 inch, *Ips* 1/3 to 1/4 inch.

Signs and Symptoms of MPB Attack

- Popcorn-shaped masses of resin, called “pitch tubes,” on the trunk where beetle tunneling begins. Pitch tubes may be brown, pink or white (Figures 2 and 6).
- Boring dust in bark crevices and on the ground immediately adjacent to the tree base.
- Evidence of woodpecker feeding on trunk. Patches of bark are removed and bark flakes lie on the ground or snow below tree.
- Foliage turning yellowish to reddish throughout the entire tree crown. This usually occurs eight to 10 months after a successful MPB attack.
- Presence of live MPB (eggs, larvae, pupae and/or adults) as well as galleries under bark. This is the most certain indicator of infestation. A hatchet for removal of bark is needed to check trees correctly (Figures 3, 5 and 8).
- Bluestained sapwood (Figure 9). Check at more than one point around the tree’s circumference.



Quick Facts

- Mountain pine beetles (MPB) are the most important insect pest of Colorado’s pine forests. MPB often kill large numbers of trees annually during outbreaks.
- Trees that are not growing vigorously due to old age, crowding, poor growing conditions, drought, fire or mechanical damage, root disease and other causes are most likely to be attacked.
- For a long-term remedy, thin susceptible stands. Leave well-spaced, healthy trees.
- For short-term controls, spray, cover, burn or peel attacked trees to kill the beetles. Preventive sprays can protect green, unattacked trees.
- Always carefully read and follow all label precautions before applying insecticides for MPB prevention.

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Figure 2: “Pitch tubes” indicating trunk attacks by MPB. Success of the attacks is confirmed by looking under the bark with a hatchet for beetles, their tunnels and/or bluestaining.



Figure 3: Top view of adult MPB (actual size, 1/8 to 1/3 inch).



Figure 4: Mountain area infested by MPB, showing three years of mortality. Old, dead trees are gray; newly killed trees are straw yellow or orange. Some trees may also be infested but do not turn color until nine months or so under attack.

Life History and Habits

Mountain pine beetle has a one-year life cycle in Colorado. In late summer, adults leave the dead, yellow- to red-needled trees in which they developed. In general, females seek out large diameter, living, green trees that they attack by tunneling under the bark. However, under epidemic or outbreak conditions, small diameter trees may also be infested. Coordinated mass attacks by many beetles are common. If successful, each beetle pair mates, forms a vertical tunnel (egg gallery) under the bark and produces about 75 eggs. Following egg hatch, larvae (grubs) tunnel away from the egg gallery, producing a characteristic feeding pattern.

MPB larvae spend the winter under the bark. Larvae are able to survive the winter by metabolizing an alcohol called glycerol that acts as an antifreeze. They continue to feed in the spring and transform into pupae in June and July. Emergence of new adults can begin in mid-June and continue through September. However, the great majority of beetles exit trees during late July (lodgepole pine) and mid-August (ponderosa pine).

A key part of this cycle is the ability of MPB (and other bark beetles) to transmit bluestain fungi. Spores of these fungi contaminate the bodies of adult beetles and are introduced into the tree during attack. Fungi grow within the tree and assist the beetle in killing the tree. The fungi give a blue-gray appearance to the sapwood.

Infested Trees

- Once MPB infests a tree, nothing practical can be done to save that tree.
- Under epidemic or outbreak conditions, enough beetles can emerge from an infested tree to kill at least two, and possibly more, trees the following year.
- *Ips* and related beetles that emerge early in summer often are mistaken for mountain pine beetle, leading to early reports that “MPB is flying.” Be sure to properly identify the beetles you find associated with your trees.
- Trees from which MPB have already emerged (look for numerous round, pitch-free exit holes in bark) do not need to be treated.

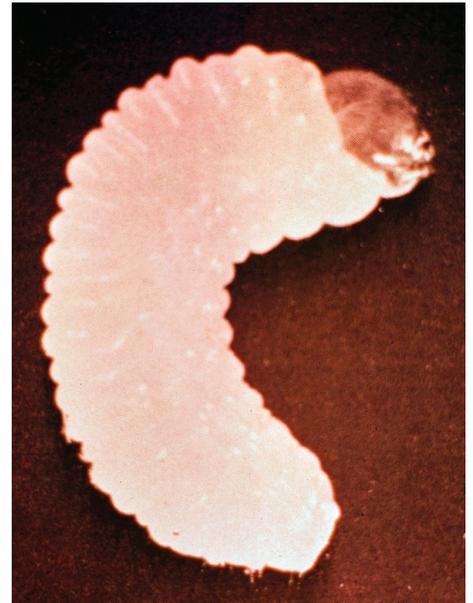


Figure 5: Larva of MPB (actual size, 1/8 to 1/4 inch). They are found under the bark in tunnels.

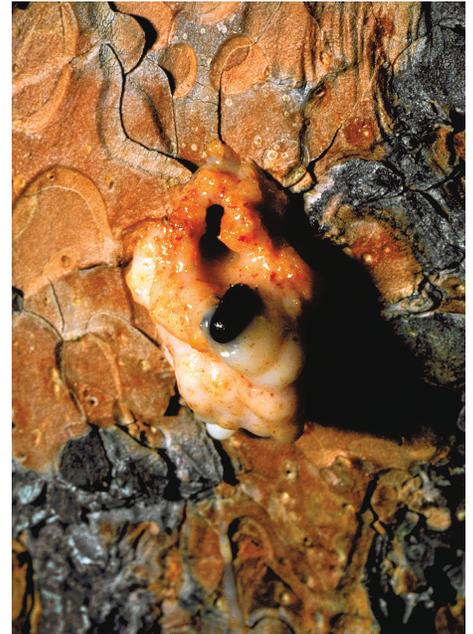


Figure 6: Not all pitch tubes indicate successful attacks. Note the beetle trapped in this large pitch tube. If the majority of tubes look like this, the tree may have survived the current year’s attack.

- The direction and spread rate of a beetle infestation is impossible to predict. However, attacked trees usually are adjacent to or near previously killed trees.

Control

Natural controls of mountain pine beetle include woodpeckers and insects such as clerid beetles that feed on adults and larvae under the bark. However, during outbreaks these natural controls often fail to prevent additional attacks.

Extreme cold temperatures also can reduce MPB populations. For winter mortality to be a significant factor, a severe freeze is necessary while the insect is in its most vulnerable stage; i.e., in the fall before the larvae have metabolized glycerols, or in late spring when the insect is molting into the pupal stage. For freezing temperatures to affect a large number of larvae during the middle of winter, temperatures of at least 30 degrees below zero (Fahrenheit) must be sustained for at least five days.

Logs infested with MPB can be treated in various ways to kill developing beetles before they emerge as adults in summer.

One very effective way to kill larvae developing under the bark (though very



Figure 7: Checking beneath the bark for MPB. This attack was successful (note tunnels and stain).

labor intensive) is by peeling away the bark, either by hand or mechanically; this exposes the larvae to unfavorable conditions – the larvae will dehydrate, starve and eventually die. Logs may also be burned or scorched in a pile – preferably when there is snow on the ground (contact your local forester for assistance). They can also be buried under at least eight inches of soil, or chipped. Following beetle emergence, wood can be used without threat to other trees.

Chemical control options for MPB larvae have been greatly limited in recent years. At present, there are no labeled pesticides for use on MPB.

Solar treatments may be appropriate in some areas of Colorado to reduce beetle populations in infested trees. For the treatment to be effective, the temperature under the bark must reach 110 degrees Fahrenheit or more. Such treatments can be performed with or without plastic. This method is also labor intensive; contact your local forester for more details on solar treatments.

Prevention

An important method of prevention involves forest management. In general, MPB prefers forests that are old and dense. Managing the forest by creating diversity in age and structure will result in a healthy forest that will be more resilient and, thus, less vulnerable to MPB. Most mature Colorado forests have about twice as many trees per acre as those forests which are more resistant to MPB. Contact your local forester for more information on forest management practices.

Certain formulations of carbaryl (Sevin and others), permethrin (Astro, Dagnet and others), and bifenthrin (Onyx) are registered for use to prevent attacks on individual trees. These sprays are applied to living green trees in early summer to kill or deter attacking beetles. This preventive spray is generally quite effective through one MPB flight (one year). During epidemic conditions, the pressure from beetle populations may result in less satisfactory results due to several factors:

- Misidentification of healthy trees: Under dry conditions, trees may not produce pitch tubes when infested, therefore healthy trees are not as obvious. Time may need to be spent looking for sawdust around a tree's circumference and at the base of the tree.



Figure 8: Characteristic tunnels (galleries) of mountain pine beetle made by the adults and larvae. The underbark area looks like this in late spring. Bluestained wood is caused by fungi the beetles introduce.

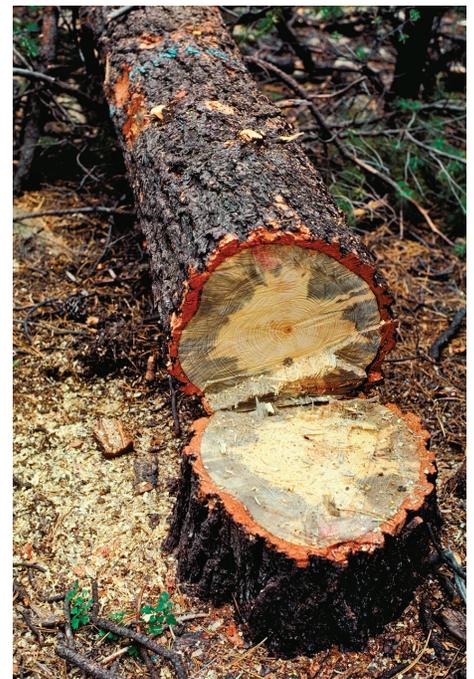


Figure 9: Cut tree killed by MPB, showing the characteristic blue-staining pattern.



Figure 10: Large, uninfested pine being preventively sprayed. This protects high-value trees and should be done annually between April 1 and July 1.

- Timing of application: Trees sprayed after June may already have been attacked.
- Improper coverage: Spray may not have been applied high enough (up to where the trunk tapers to less than six inches), or spray coverage of the tree did not begin at ground level, or was not applied to the entire circumference of the tree (thus creating “windows” for beetle attack).
- Improper dosage/mixing of chemical: Low dosage – effective dosages for bark beetles are higher than the percent used for other insects. Mixture – the carbaryl and water were not fully mixed.
- Environmental conditions: Significant rain or moisture within two hours of application may wash off the insecticide. Very high temperatures may break down the chemical (this can occur when treated trees are near forest fires).
- Chemical shelf life/storage: Manufacturers guarantee stable

chemical properties for at least two years after manufacturing date, if stored properly. Chemical properties of carbaryl may be altered if stored at very high or very low temperatures.

- Improper volume/formulation: Not enough spray is used to cover the bark area susceptible to beetle attack; lodgepole pine has “flaky” bark which may require more spray. The label on the chemical does not indicate bark beetle prevention (if using Sevin, SL or XLR is recommended).

Always carefully read and follow all label precautions before applying insecticides for MPB prevention.

Related Fact Sheets

5.543, *Western Spruce Budworms*

5.558, *Ips Beetles*

Contact the Colorado State Forest Service for additional information related to mountain pine beetles.



Figure 11: The appearance of a forest thinned to help prevent MPB. This can also improve mountain views and reduce fire hazard.



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