University of Nevada
Cooperative Extension

PINYON PINE

Management Guidelines For Common Pests

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INTRODUCTION

Pinyon pine (*Pinus monophylla)* woodlands occur on many of the mountain ranges of Nevada. With development spreading into these woodlands, home landscapes often include singleleaf pinyon. Home-owners wishing to maintain these native landscapes need to know how to take care of the native pines. This guide will help homeowners identify and manage common pests of pinyon pine. The guide discusses general practices to maintain healthy trees, lists specific pests, and outlines management strategies.

DESCRIPTION

One of Nevada's two state trees, singleleaf pinyon is also one of the predominant trees in the Great Basin, growing not only in Nevada, but also in parts of California, and western Utah. It tolerates drier conditions better than other Nevada pines. In the drier portions of its range, it is often found in association with Utah juniper (*Juniperus osteosperma)*. It grows at elevations ranging from approximately 3,200 feet to 9,200 feet.

Singleleaf pinyon is a slow growing conifer, taking as long as 60 years to reach about 6.5 feet. However, it typically grows from 2 to 4 inches per year with mature trees reaching 20 feet to 40 feet, depending on the site quality. Its life span can be greater than 600 years.

Across its extensive range in the state, pinyon is important to wildlife, providing food and cover for many species including birds and large and small mammals. Trees are also of considerable cultural value to Native Americans of the Great Basin.

KEEPING TREES HEALTHY

Healthy trees have fewer insect and disease problems than trees that are stressed. It is important to keep trees vigorous by reducing human-caused stress factors such as improper irrigation, construction damage, soil compaction, and improper fertilizer or chemical use.

Pinyon pines in home landscapes require minimal maintenance. They are growing in their native habitat, and therefore are adapted to the site. Irrigation and fertilization are typically unnecessary except when trees have been damaged by human activity or weather.

Avoiding Stress Factors: Humans often impact trees with their daily activities. Trees that have been injured, above- or below-ground, are prime candidates for attack by insects and diseases. Root damage is a common source of tree stress caused by humans.

Root systems of pinyon are often damaged by overwatering. Because their native habitats are drier than those of other pines, too much water can cause root problems and death. Homeowners used to watering landscape trees such as Austrian (*Pinus nigra)* or Scotch (*Pinus sylvestris)* pine regularly through the summer, often mistakenly irrigate their pinyon similarly. Pinyon trees should never have irrigated landscapes planted around them.

Constant irrigation can rot pinyon roots, causing diseases, branch dieback, and death.

The pinyon's growth, starting in April and ending in September or October, is supported by stored soil moisture rather than spring or summer rains. Watering a pinyon pine should mimic natural rain or snow, and should be done primarily from December to April if a winter is unusually dry.

During periods of drought in winter and early spring, trees should be given a deep watering monthly. Keep water away from the root crown (Figure 1, next page).

An exception to the "don't irrigate pinyon" rule is when trees have lost roots due to excavation. Then it is necessary to provide supplemental irrigation to keep soil moist through the growing season (May to September). This should encourage new root development to replace damaged roots. Be careful not to overwater; allow soil to drain between waterings. Do not leave standing water in the root zone. Pinyon pines need well-drained soils.

Construction often damages trees by compacting soil, destroying roots, and scraping bark. In order to protect trees from construction hazards, protective zones should be established around individual trees and groups of trees. These zones should be clearly delineated with brightly colored flagging.

Since pinyon roots often extend out from the trunk two to three times the tree's height, and are located near the soil surface, it is difficult to avoid damaging them. Therefore, it is important to consider these root systems when locating structures, access lanes, and utility lines. Avoid paving over tree roots.

At a minimum, keep construction-related activity outside the dripline of trees planned for retention (Figure 1).

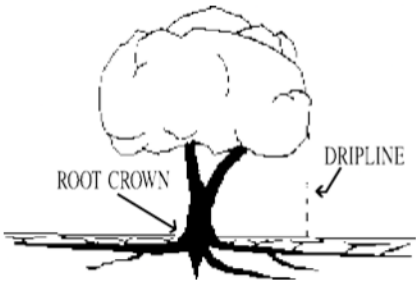


Figure 1. Tree's dripline and root crown

Correcting Existing Problems: Homeowners often inherit tree problems upon purchase of a property. What can be done to reduce stress factors and encourage tree vigor in this case?

Prune off any broken branches or branch stubs. Pruning cuts should follow natural target pruning guidelines (Figure 2).

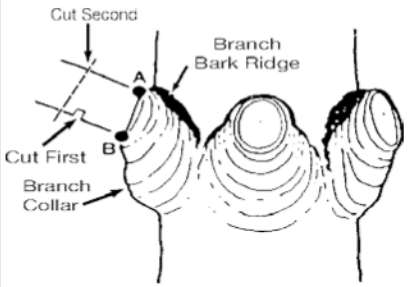
Remove any soil deeper than 6 inches added during recent construction over a tree's root zone down to the original soil grade. Aerate and mulch compacted soils and older fill.

Loose bark should be removed from the edges of wounds on the trunk or branches with a sharp knife. Do not remove bark that is firmly attached. Don't use a sealant on wounds; leave them exposed.

Natural Target Pruning

1. Find Target A — Just outside of the branch bark ridge.
2. Find Target B — Swelling where branch meets collar.
3. Make cuts — Use the 'three-cut' method for two inch and larger limbs. Make a first cut on the underside of the branch 8 to 10 inches from where the branch connects to the trunk.

Cut a third to halfway through the limb. Make the second cut from 1 to 3 inches outside the first cut, starting on the top and cutting through the branch. Make the final cut at line AB, just outside the branch collar.



DO NOT:

- Cut behind the branch bark ridge
- Leave stubs
- Cut branch collar
- Paint cuts

Figure 2. Natural target pruning

Trees that have sustained significant root damage may need to be sprayed with an insecticide for one to two seasons to protect them from bark beetle attack.

There are no chemical sprays to save trees that are already infested with beetles. However, spraying uninfested trees with insecticides can protect them during times of stress or following injury. Spray the main trunk and all branches up as high as possible on uninfested trees. March is the best time to spray. Contact Nevada Department of Agriculture for a list of pesticides registered for bark beetle on pine.

Another corrective action that can be taken in an existing landscape is to remove lawn or other plantings requiring water from the area between the trunk and the dripline of the tree.

PINYON FOREST MANAGEMENT GUIDELINES

The management guidelines for pinyon contained here are very general. Specific recommendations need to be tailored to the individual site and take into consideration the landowner's objectives.

Thinning: One of the primary factors leading to poor tree health is too many trees spaced too closely. Thinning, the selective removal of individual trees to reduce tree density, is an important management practice that improves tree health and vigor and decreases wildfire potential as well.

Little research-based information exists from which to develop guidelines for thinning in pinyon stands. There are, however, many general considerations that apply to all forest types that should be considered when selecting trees for removal.

Remove declining trees with dead and dying branches and sparse foliage. Trees infected with dwarf mistletoe (see page 27), a parasitic plant, and those with numerous branch and stem cankers are also good choices for removal. Insect infested trees should be evaluated for removal as well. Retain trees that have been good cone producers. Look for immature and old cones in the branches and accumulations of fallen cones beneath the tree (Figure 3).

Keep large trees with healthy, vigorous crowns (Figure 4, next page). If your property has both pinyon and juniper, keep junipers too. A mixed stand will help deter the spread of insects and diseases.

Try to achieve a spacing between trees that is roughly equivalent to one and a half times the average tree height. Since all trees on a property will not be the same size, attempt to estimate the average height. By using this spacing guideline, the number of trees retained per acre will be

Figure 3.
Good cone production

greater with smaller trees, and conversely, lower with larger trees.

Timing of Cutting and Slash Management: Cutting operations should be carried out during late fall and winter. This is the time when insects are inactive and less likely to be attracted by freshly cut material. This will also allow time to clean up the slash and debris created by management activity prior to the insects becoming active the following spring.

Ideally, slash should be removed from the property. Alternatively, the wood can be left on site and cut into 12-inch lengths. Keep wood exposed to the drying sun. Split pieces larger than 8 inches in diameter to speed the drying. Chipping and burning are also satisfactory methods of disposal. Avoid creating large amounts of slash in successive years, particularly during drought. Keep chip piles away from live trees. They can attract bark beetles to the area.

Any infested material should be removed from the site or burned before the insects mature. To use the material for firewood, pile it in direct sunlight and cover with at least four mil clear plastic. The smaller the pile, the more effective this is – keep it just a few logs high. Be sure all edges of the plastic are buried and avoid tearing it. Leave the pile covered for three months during hot weather, and longer during cooler times of the year. Heat trapped under the plastic will make the wood unsuitable for bark beetles.

Figure 4.

Pinyon with a healthy crown and large cone crop

COMMON PESTS

In Nevada, there are a number of insects and diseases of pinyon. The following pests account for the majority of problems a homeowner is likely to encounter.

INSECTS

Pinyon *Ips* Beetle
Ips confusus

Indicators: If you notice a pinyon changing color from green to yellow and finally to a reddish-brown (Figure 5), it may be infested with the pinyon *Ips* beetle (Figure 6).

Figure 5. Pinyon color change

By the time the color changes, the beetles have usually left the tree, so carefully inspect green trees nearby for new attacks.

Figure 6. Adult *Ips* beetle (L. Livingston)

Look for boring dust (frass) collected in the bark crevices and at the base of the tree. Small globules of pitch (pitch tubes) and frass may be present at the entrance holes and in the bark crevices (Figure 7, next page). Egg tunnels or galleries will be visible beneath the bark (Figure 8, next page).

Description: Pinyon *Ips* beetles or engraver beetles are native to Nevada's woodlands. The adult beetles are dark brown to black and approximately 0.2 inches long (Figure 6). They first attack trees in the spring as they emerge from woody

Figure 7. Pitch tubes with boring dust

material infested the previous fall. They continue their attacks throughout the summer.

If the attack is successful, the male beetles release a chemical attractant, a pheromone, drawing a mass attack of other male and female beetles.

The males bore through the bark and build a nuptial chamber in which they mate with multiple females. The female beetles then bore egg galleries away from the nuptial chamber, laying eggs singly along both sides (Figure 8).

Figure 8. *Ips* galleries (D. McComb)

Unlike most other bark beetles, *Ips* egg galleries are free of sawdust and are etched into the wood (hence the name "engraver" beetles).

The eggs hatch into small white larvae that feed on the inner bark, and move out at right angles from the egg gallery. After a few weeks, they complete their growth, form a pupal chamber at the end of the feeding gallery, transform into pupae, and then become adults.

The adults bore out of the tree and fly to new trees to begin another generation. They produce three to four generations per year with the first generation emerging in April or May, depending on temperature. The first generation typically infests freshly damaged material, such as downed trees and broken branches.

This material is still green and provides a ready food source for the first generation, whereas live trees are most vigorous in early spring and are resistant to attacks. Trees become more susceptible as drier summer months progress.

The beetles carry a wood-staining fungus into the attacked tree.

The combination of larval feeding in the inner bark and the fungus may combine to eventually kill the tree.

Prevention and Management: Since beetle attacks on healthy trees are usually unsuccessful, keep trees healthy and vigorous. Thin overcrowded stands according to the guidelines presented earlier and prune out mistletoe infestations. See "*PINYON FOREST MANAGEMENT GUIDELINES,*" page 13.

For chemical spraying guidelines, see page 11.

Red Turpentine Beetle
Dendroctonus valens

Indicators: Red turpentine beetles typically attack stressed or dying trees, freshly cut logs, and stumps. Their attacks are rarely fatal, however, they indicate a weakened tree and can predispose it to attacks by other bark beetles.

The most obvious signs of red turpentine beetle attack are large (up to 2 inches wide) reddish globules of pitch (pitch tubes) at the point of entry (Figure 9).

These are located on the lower part of the tree trunk and on the root crown. Very weak trees may not produce much pitch in response to the beetle attack, and pitch tubes may be missing. However, accumulations of reddish-brown boring dust will be present at the base of the tree and in bark crevices. Piles of coarse, granular pitch are often present with the boring dust.

Figure 9.
Pitch tubes from red turpentine beetle (B. Oakes)

The beetles also introduce a blue stain fungus into the tree. The fungus grows in the live wood tissue staining the wood blue.

Description: The adult beetle has a distinctive reddish-brown color and is 0.25 inch to 0.5 inch long, making it the largest bark beetle (Figure 10).

The adults attack trees throughout the warm season and generally peak by mid-summer. The female beetle bores through the bark and is soon joined by a male with whom she breeds.

The beetles then chew a 0.5-inch to 1-inch wide egg gallery between the bark and wood. The gallery normally extends down from the entrance hole and is filled with frass. The female lays groups of eggs, up to 100, along the sides of the gallery.

In one to three weeks the eggs hatch into white larvae with brown heads and a brown area on the hind ends. The larvae then tunnel in groups away from the egg gallery. The group-feeding characteristic of red turpentine beetle larvae is unique and produces large chambers in the inner bark, rather than the individual larval tunnels as most other beetles produce.

After two or more months, the larvae transform into pupae. They remain in this stage for another week or so as they turn into adult beetles.

The beetles then bore out through the bark, leaving small round exit holes, and fly to other trees to begin another generation. The beetles normally produce one generation per year, but may produce more in warmer climates. They spend the winter under the bark in either the adult or larval stage.

Prevention and Management: Stressed and weakened trees are most often successfully attacked by red turpentine beetles. Follow thinning and slash management guidelines presented earlier to prevent beetle problems. For insecticide spraying recommendations, see page 11.

Figure 10.
Adult red turpentine beetle
(T.W. Davies)

Twig Beetle

Pityophthorus spp.
Pityogenes spp.

Indicators: Trees infested by twig beetle will have branch tips that are brown and dead. Careful examination of the small branches will reveal small pitch tubes where the insects have entered the branch (Figure 11). Bark on infected twigs may appear sunken and wrinkled (Figure 12).

Figure 11. Twig beetle pitch tubes

Figure 12. Sunken wrinkled bark resulting from twig beetle mining

Description: Another bark beetle, the twig beetle, attacks twigs less than 0.5 inch in diameter and the terminal growth. During drought conditions, the beetles will move to larger branches and the trunks of smaller trees.

These beetles are approximately 0.1 inch in length. An infestation of twig beetles will usually not kill a tree, but will predispose it to other insect attacks or disease.

Twig beetles attack pinyon and other pine species. Natural outbreaks fluctuate year to year, but increases in populations may be encouraged by drought and mild winters. There are two generations or more per year.

Eggs are laid in the twigs. Then larvae tunnel into the food transporting systems and inner bark, killing the twig.

A gallery down the middle of the twig is made for overwintering. Exit holes are similar to the other bark beetles, but occur at the base of twigs rather than on the trunk or branches.

Prevention and Management: Remove and destroy the dead twigs and branches. Winter is a good time to prune out the infested material, because the adult beetles will also be removed. Cut the twigs back to green growth.

The same chemical sprays that deter pinyon *Ips* beetle will also work against twig beetles. Chemicals will not kill insects already in trees, but may prevent successful attacks on uninfested trees.

Pinyon Needle Scale
Matsucoccus acalyptus

Indicators: This is a sap-sucking insect that feeds on previous years' needles. It weakens trees by killing needles. Small trees may be killed by repeated feeding, and large trees weakened to the point that they succumb to bark beetle attacks.

Foliage of infested trees turns yellow (chlorotic), then brown. Needle length is reduced and needles drop prematurely. Foliage of trees damaged for several years is chlorotic and thin. Trees with long-lasting infestations will have a few short needles clustered at branch tips.

Description: Adult scales look like small, black bean-shaped objects (Figure 13). Wingless females emerge in April after overwintering in immobile waxy shells on the needles.

They then mate with winged males, which are seen in large numbers flying around scale-infested trees.

After mating, females crawl to several sites on the tree, such as bark crevices, branch crotches, undersides of branches, and the root collar. There they lay clusters of oval yellow eggs held loosely together with thin sheaths of yellow cottony webbing that look like cotton candy (Figure 14, next page).

In about four weeks, red eyespots become visible on the eggs. Seven to 10 days later, tiny yellow crawlers emerge. The crawlers move to the ends of branches, settling on year-old needles. They insert their sucking mouthparts and become immobile, covering their bodies with wax and turning black. This all happens in about one day following emergence. Feeding continues through the summer.

Figure 13.
Pinyon needle scale

Eventually, the scales grow too large for their initial waxy shell, which ruptures. A second developmental stage occurs on the needles as the scale develops a new waxy shell. The immature males emerge from this second stage in October or November. They have legs and crawl to the ground, where they spin loose webs under stones, twigs, or in plant litter. Females spend the winter immobile on needles. The life cycle is completed in one year.

Prevention and Management: Thoroughly wash the yellow cottony egg masses from branch crotches, undersides of branches, and trunk of the tree with a garden hose and spray nozzle. Rake up litter and egg masses from the area under the tree. Place the litter in plastic bags and dispose of it immediately. In addition, a band of a sticky trapping substance available from nurseries can be applied at the base of the washed tree trunk to prevent crawlers on the ground from gaining access to the tree crown.

Washing will be effective only when the insects are in the egg stage, before crawlers emerge and disperse. This usually takes place in the beginning to middle of May or earlier in southern areas. Drenching trunk sprays are specifically registered for use on this insect. These should be applied against the adult stages in early spring before egg laying. Sprays used against other scale insects should also be effective. Check with the Nevada Department of Agriculture for registered insecticides.

Figure 14.
Pinyon scale egg masses

Figure 15. Pitch masses

Pitch Mass Borer
Dioryctria sp.

Indicators: The larvae of this small gray moth feed on the inner bark of pinyon and other pines. In their feeding, they excavate under the bark, causing wounds 2 inches to 4 inches in diameter. The tree produces large masses of pinkish-white pitch in response to the feeding (Figures 15 and 16). The injuries caused by these attacks weaken the host tree and kill individual branches. Heavily impacted trees are susceptible to attacks by other insects. The large amounts of pitch produced also increase the tree's flammability.

Description: The borers live in the tree for one to two years and emerge as adult moths. The adult lays eggs in bark crevices or near wounds throughout the summer months. The eggs hatch into larvae that bore into the branch or trunk.

Prevention and Management: Maintain tree vigor. See "*KEEPING TREES HEALTHY,*" page 9. Avoid pruning or inflicting other injuries to the branches and trunk during summer when the adult borers are active. Individual larvae can be controlled by removing the pitch mass and removing the larvae from under the bark with a knife or other sharp tool. Spraying trunks thoroughly with insecticide can reduce new attacks. Check with the Nevada Department of Agriculture for registered insecticides.

Figure 16. Pitch masses

Pinyon Tip Moth
Dioryctria albovitella

Indicators: Larvae of this small, grayish moth feed in the branch tips of pinyon, killing new shoots and giving the tree a scorched appearance (Figure 17). Although the damage can be conspicuous, these larvae have little effect on overall tree health. However, they can slow growth and deform trees.

Description: Adult moths lay eggs in midsummer. The eggs hatch soon after, but do no damage in this early larval stage.

The new larvae form a silken cocoon on the bark and spend winter in this stage. They emerge from the cocoon in late spring or early summer and begin feeding on unopened buds. They often will destroy the bud and move to another developing shoot or developing cone to continue feeding. They pupate in the shoots or cones and emerge in midsummer to begin the cycle again.

Prevention and Management: As stated above, the damage caused by this insect is superficial. However, it can be controlled with insecticides.

Spraying with insecticide in May, prior to the larvae entering new buds, should be effective.

Spraying later in summer, when larvae are moving to new food sources, should also work. Check with the Nevada Department of Agriculture for registered insecticides.

Figure 17.
Tip moth damage

Pinyon Sawfly
Neodiprion edulicolus

Indicators: Sawfly larvae feed in colonies on the foliage of pinyon. Young larvae feed on the current year's needles, taking small bites that skeletonize the needle. Older larvae consume entire needles.

These sawflies typically go undetected because they occur in small numbers, causing little damage. However, they have become epidemic in the past, causing widespread defoliation and mortality of smaller trees.

Description: The adult sawflies, wasp-like insects, lay eggs in needles in late October and early November. The eggs hatch in early April and groups of new larvae move to the tips of adjacent needles to feed (Figure 18). In June, the larvae drop to the ground and form cocoons beneath the litter layer (duff) or soil. The larvae pupate in the fall and emerge as adult sawflies in October or November.

Prevention and Management: On individual trees, sawfly larvae can be blasted out of the tree with a garden hose. Most broad-spectrum insecticides kill exposed larvae. Insecticidal soaps and narrow-range oils will also kill larvae and are less toxic to other non-target organisms.

Figure 18. Sawfly larvae group feeding (G. Durham)

DISEASES

Black Stain Root Disease
Leptographium wageneri* var. *wageneri

Indicators: The black stain fungus causes a root disease that clogs water-conducting tissues of the roots, root collars, and lower stems of pinyon, and blocks the movement of water to the needles. The fungus creates an arcing pattern on roots (Figure 19). Black stain kills young trees within a year or two of infection. Older trees decline more slowly, but become susceptible to bark beetle infestation.

Description: Infected trees show symptoms of gradual decline, with a reduction in terminal growth and yellowing older needles. With the progression of the disease, older needles drop off prematurely and new needles may be stunted and yellow. This causes growth in advanced stages to be compact, yellow, and sparse, creating a tufted look. There may even be a "distress" cone crop, an abundant crop of cones.

Root feeding beetles and weevils may act as vectors, or carrying agents of the disease, spreading the disease organism as they feed and breed in recently dead or dying trees. As the beetles emerge, they are contaminated with spores and then move on and contaminate new host trees. Root contact with adjacent trees is likely the most important means of spread.

The fungus may also inhibit the flow of pitch, reducing the tree's protective mechanism that would normally allow it to push out bark beetles.

Although pinyon can be a host for black stain root disease, disease occurrence is not widespread. It is more appropriately considered a disease associated with certain locations, rather than intimately tied to pinyon. It is also found on ponderosa and Jeffrey pines. In those species it is associated with site disturbance and damage to tree roots. This association with disturbance has not been demonstrated with pinyons.

Figure 19.
Infected root, note arcing pattern of Black Stain fungus (USDA Forest Service)

Prevention and Management: There is no cure for diseased trees. By reducing damage during construction, site disturbances, and tree injuries, further spread of the disease may be reduced. Avoid soil compaction. Do not cover root crowns with soil or partially bury trees. Avoid changing drainage. For small, isolated infections, stump removal may eliminate further infections.

Pinyon Needle Rust
Coleosporium jonesii

Indicators: Pinyon needle rust can destroy enough foliage to disfigure or slow the growth of young pinyon pines, but rarely causes significant damage that threatens tree health.

Description: The cycle for rusts, whether on leaf or stem, requires one year and two host plants. Pine needles are infected in late summer to early fall with no evident symptoms. The disease organism overwinters in the needles. By spring, needles show yellow spots, with an eventual rusty colored oozing (exudation) occurring (Figure 20).

As this disappears toward the end of summer, tiny scars or bands on green or partly yellowed needles occur. The fungal spores are then dispersed by the wind, infecting the alternate hosts, currants and gooseberries (*Ribes* sp.). The organism repeats its growth and dispersal cycle and reinfects pines.

Prevention and Management: To help prevent needle rusts, do not plant the alternate hosts currants or gooseberries in the area. Prune infected tree branches and dispose of them by burning or removing them from the site.

Figure 20. Heavy needle rust infection (P. Murphy)

Pinyon Blister Rust
Cronartium occidentale

Indicators: Another rust disease, pinyon blister rust causes branch and trunk swellings. It also needs currants or gooseberries to complete its life cycle.

Description: Blister rusts deform and kill trees or individual branches. Spores are released at night and spread by wind. They land on and infect pine needles, shoots, and cones. The disease then spreads into the branches and trunks, causing galls, cankers, and dieback (Figure 21). The activity of pinyon blister rust is associated with available moisture. Infections are more likely to be evident in wet years.

Prevention and Management: To help prevent blister rusts, do not plant the alternate hosts currants or gooseberries in the area. Cut off infected tree branches and dispose of them by burning or removing them from the site.

Pinyon Dwarf Mistletoe
Arceuthobium divaricatum

Indicators: The first visible sign of pinyon dwarf mistletoe infection is a spindle-shaped swelling on a young branch. Two to three years following infection, the plant produces yellow to light-green, leafless shoots up to 8 inches long (Figure 22, next page).

"Witches brooms", deformed loosely arranged masses of twigs and foliage, are another symptom of the disease that is easily visible in the crowns of infected trees (Figure 23, next page).

Over time, the foliage of infected trees becomes thin, short, and yellowish, and the tree begins to die.

Description: Dwarf mistletoe is a parasitic plant that causes widespread damage to pinyon. The plant spreads primarily by seed. The berry-like fruits ripen in the late summer or fall and burst, shooting their sticky seeds to other branches or trees.

Figure 21.
Pinyon blister rust with typical bark blisters and rodent feeding (G. Durham)

Figure 22.
Pinyon dwarf mistletoe with swollen branch (F. Hawksworth & D. Wiens)

Seeds can travel horizontal distances equal to their height in the tree. The seeds adhere to needles, twigs, branches, and trunks. They germinate the following spring. Infection of the host occurs when the root-like structure from germinated seed successfully penetrates the bark.

The root-like system becomes embedded in the wood and provides the mistletoe with water and nutrition from the host tree. The mistletoe plant continues to grow and spread in the host. Shoots of mistletoe form within two to four years, and fruits are produced in another one to two years.

Dwarf mistletoe weakens trees by robbing them of food and water changing the balance of plant hormones that control growth. Infected trees grow more slowly, have deformed branches, and produce less seed. The parasite can also kill trees. Seedlings and saplings can be killed before they grow into large trees, while larger trees can live for many years with mistletoe infections. The disease slowly weakens trees, making them more susceptible to other pests like bark beetles.

The length of time it takes for mistletoe to kill a tree depends on the age of the tree, how vigorous the tree is, and how heavily infected with mistletoe the tree is.

Prevention and Management: The best treatment option for mistletoe depends on the degree of infection, the age and location of the tree, and concerns of property owner.

Trees with severe infections, dwarf mistletoe rating equal to 5 or 6 (Figure 24, next page), and those with only a few live branches should be removed. Trees with high, unreachable infections should also be removed to keep them from raining seeds on uninfected trees below. Removal of heavily infected trees also eliminates the hazard that diseased trees can become around the home.

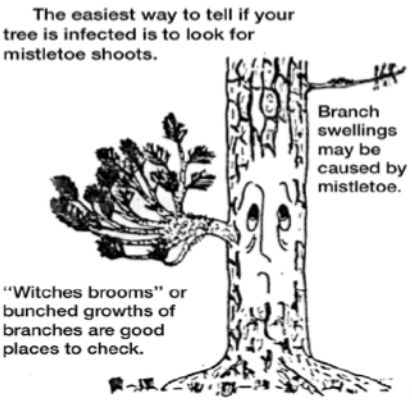


Figure 23. Common dwarf mistletoe symptoms

All trees, particularly older ones, should be examined to determine if decay, disease, or any other defect has created hazardous conditions. If the trees are isolated from uninfected pinyons (minimum separation of 30 feet) they may be retained for their aesthetic benefits.

Pruning infected branches can benefit trees with less severe infections. Removing witches brooms can improve the tree's health and lengthen its life. If more than 50 percent of the tree's crown needs to be removed to eliminate the infections, it is best to remove the entire tree.

Remove infected branches where they join the trunk or at branch junctions. Remove the entire branch rather than just the infected section, as not all infections will be visible. Cut all visibly infected branches and two layers of branches above and below all infections. Forty percent of the total tree height should contain live branches following pruning.

Mistletoe infections on branches within 6 inches of the tree trunk will likely have spread into the main tree stem. If the main stem is less than 5 inches in diameter where the infected branch attaches, the entire tree should be removed. Otherwise, remove the infected branch and periodically scrape shoots off the trunk should they appear.

Examine pruned trees every two or three years. Prune out any additional infections and knock off new mistletoe shoots to slow its growth and seed spread.

An environmentally safe, growth-regulating chemical, *ethephon*, has been used to control the spread of dwarf mistletoes.

It causes the shoots to dehydrate and fall off. This treatment will not kill the parasite, but will slow its spread by seeds.

Thoroughly cover all shoots with the spray (until wet) to obtain good results. The chemical should be applied by mid-August before seed dispersal. Reapplication is needed as new shoots grow back to maturity and again produce seed.

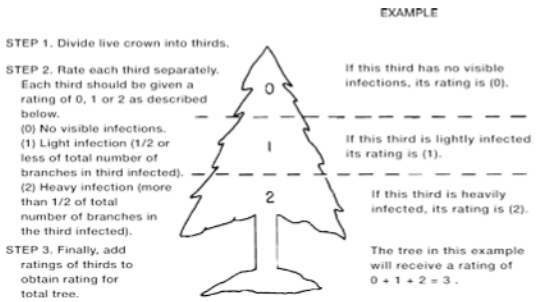


Figure 24. Dwarf mistletoe rating system

CONCLUSION

Pinyon pines are important trees in the Great Basin. In the home landscape, they provide ecological, aesthetic, and financial value to the property. The trees are assets when they are healthy and growing vigorously. If properly cared for, they will be long-lived, providing beauty, wildlife habitat, and watershed protection. If not cared for, the trees can become a liability. Trees damaged by careless activity can become structurally unsound from decay fungi entering wounds. Wounded trees are susceptible to attacks from insects that can kill them and then spread to infest trees in surrounding areas. Dying or dead trees and dense stands of trees around a home create a high fire hazard.

By following the guidelines and recommendations in this publication, landowners can ensure the pinyons on their property are an asset, rather than a liability. They will provide years of benefit to the property and its users.

GLOSSARY

Aerate – To physically "open" up a soil to allow air to penetrate, typically done with a core pulling machine.

Canker – A lesion on a stem; a plant disease causing tissue dieback on bark.

Canopy – The leafy portion of a tree or stand of trees.

Chlorotic – The yellowing of green portions of a plant, particularly the leaves or needles.

Crown – The foliage bearing branches of a tree.

Dripline – The ground area under the branches of a tree from the outermost reaching branches to the trunk.

Duff – The partially decomposed organic matter (litter of leaves, flowers, and fruits) found beneath plants, as on a forest floor.

Dwarf mistletoe rating system – A simple method for evaluating the severity of dwarf mistletoe infections in a single tree or a stand of trees.

Exudation – Liquid discharged from diseased or damaged plant tissue.

Fill – Soil added over existing native soil.

Frass – Sawdust like material produced by boring beetles, consisting of ground-up wood and feces.

Gall – A growth or swelling that results from attack by bacteria, fungi, or other organisms.

Galleries – Tunnels produced under the bark as boring beetles move through the tree to lay eggs, feed, mate, or exit.

Instar – The stage of an insect between successive molts.

Larva / larvae – Immature stage of an insect between egg and pupa; often caterpillar- or worm-like in appearance.

Mulch – Any loose organic or inorganic material placed over the soil.

Pheromone – Attractant chemical produced by beetles.

Pitch – Sap.

Pitch tubes – Globules of congealed sap that exude from branches and twigs.

Pupa / pupae – Resting stage of an insect between larva and adult.

Root crown – The area of transition from stem tissue to root tissue located at the base of a tree.

Skeletonize – The lacy effect produced when insects chew up most of the green tissue on a leaf or needle.

Slash – Cut tree tops and branch wood resulting from tree or forest management activity.

Soil compaction – The reduction in air and water holding capacity (pore space) of soil resulting from the effect of traffic or weight on the soil surface.

Spore – Of fungi, a one- to many-celled reproductive unit that becomes detached from the parent and that can germinate to give rise to a new individual.

Terminal – The growth at the end of a stem or trunk.

Thin – Selective removal of trees to the recommended distance to reduce competition for nutrients and water.

Vector – Carrying agent for a disease organism.

Witches broom – Loosely arranged masses of twigs and foliage.

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