

Dwarf Mistletoe

Biology and Management in Southeast Region

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Dwarf mistletoe is a parasitic plant native to western forests. It depends on its host for water and nutrients. Mistletoe has seeds, stems, flowers, and roots like other plants, but it survives only on living trees. When the host tree or branch dies, mistletoe dies.

All major conifer species are infected by mistletoe. It is the most damaging disease of lodgepole pine, western larch, and Douglas fir in the Intermountain West.

Most mistletoe species live on a specific host tree. For example, Douglas fir dwarf mistletoe lives only on Douglas fir. The same is true for mistletoe infecting ponderosa pine and lodgepole pine. Larch dwarf mistletoe sometimes infects subalpine fir and lodgepole pine.

The best way to identify mistletoe is to observe the plants. Some species of mistletoe are large and showy; others are small and difficult to see. Mistletoe is often indicated by “witches’ brooms”--a clump or mass of abnormal branch and twig growth. Witches’ brooms are most common in the lower portion of the tree crown, but brooms may occur throughout the crown in cases of severe infection. Witches’ brooms don’t always develop on infected trees even if mistletoe plants are abundant.

Biology and Life Cycle

Mistletoe seeds disperse in late summer or autumn. Seeds are “shot” like tiny bullets powered by water pressure from within the fruit. The sticky seeds adhere to needles on nearby branches. On a proper host, mistletoe seeds slide to the base of the needle and lodge on the thin bark of young branches where they germinate the following spring, establish a root system, and become a new infection. Trees can be infected at any age or size, but infection is most probable when trees are at least 5 to 10 feet tall or older than 10 years.

Seed dispersal distance varies with mistletoe species. Large ponderosa pine mistletoe plants can shoot seeds up to 50 feet and sometimes farther. Tiny Douglas fir mistletoe plants seldom shoot seeds beyond 10 feet. Larch and lodgepole mistletoes shoot seeds up to 30 to 40 feet. Overall, for all species except Douglas fir, most mistletoe seed lands well within 30 feet.

New infections not yet producing shoots are “latent”. The latent period lasts 2 to 5 years until new shoots appear. An additional 1 or 2 years is required for flowering, seeds are produced, and the infection cycle continues. Many successive mistletoe crops may be produced from a single infection site.

Mature mistletoe infections sometimes stop growing shoots becoming quiescent during drought periods or when deprived of adequate light in shaded, densely stocked stands. Thinning infected stands allows more sunlight to enter thereby activating quiescent infections.

Mistletoe spread is fastest and most effective in layered or uneven stands where seeds shed from overstory trees fall on to susceptible understory trees of the same species. Disease spread is relative slow in even or single layer stands.

Upward spread of mistletoe within an infected tree is much less effective than downward spread. Trees on good soils growing faster than the upward spread rate tend to stay ahead of the infection. On poor soils with slow growing trees, mistletoe will eventually spread to the top of the tree.

In dense stands, mistletoe seed production is often poor due to limited light and low host vigor. Many of the seeds produced are trapped in the crown limiting spread. Spacing to improve tree vigor improves mistletoe vigor, too. On good growing sites, the infected tree may outgrow the upward spread rate of infection. Wide tree spacing may accelerate spread by allowing optimal seed shooting distances before interception.

Mixed species stands are less suitable for mistletoe spread than are single species stands. In mixed species stands, non-host species immune to infection intercept dispersing seed blocking disease spread.

Tree and Forest Damage Associated with Mistletoe

Mistletoe survives by stealing water and nutrients from the host tree. The loss of water and nutrients weakens the host slowing its growth. Severely infected trees suffer topkill and often die. Other forest pests, particularly bark beetles, may attack mistletoe-weakened trees causing quick death.

Extent of damage caused by mistletoe depends on severity of infection, site quality, stand density, and forest structure. Losses tend to be greatest in stands that are infected early. Seedlings and saplings weakened by branch infections cannot compete with healthy trees, and those with stem infections usually die.

Lightly infected stands (DMR 1 or 2) suffer little on good sites if overstory sources of infection are eliminated. Lightly infected stands may become moderately infected and even heavily infected on low productivity sites especially if overstory sources of mistletoe remain. Once a stand reaches an average DMR of 3, growth reduction occurs and mortality increases.

Generally, on sites conducive to mistletoe proliferation, the DMR class progresses to the next more severe class in 10 to 20 years due to the combined effects of disease intensification within the tree and infection from adjacent trees. Infection intensifies most rapidly in sapling or pole size trees under infected larger trees.

Benefits of Mistletoe in Balanced Forests

Mistletoe has an important natural role in “balanced” forests. Mistletoe promotes diversity by creating witches’ brooms, snags, down wood, and gaps in the forest important to wildlife. Gaps encourage grasses and shrubs along with enabling juvenile timber. The benefits of mistletoe are lost in severely infected “out-of-balance” forests. Desirable forest structures (“big trees”) are steadily lost, wood production declines, and wildfire hazard increases dramatically.

Mistletoe plants and witches’ brooms provide:

- Foraging area and food for birds and small mammals
- Hiding cover, roosts, and nest sites in large witches’ brooms
- Snag habitat essential for cavity nesting birds and secondary cavity users

The ecological role of mistletoe is more than providing wildlife habitat. Large, resinous, persistent, low hanging witches’ brooms are highly flammable ladder fuels that provide a quick pathway for fire from the surface to the crown. Fire, a natural feature in a natural forest, helps control mistletoe. However, fire becomes a costly, destructive event in “out-of-balance” commercial forests, recreational forests, residential forests, and watersheds.

Mistletoe Management and Treatment Options

The acceptability of dwarf mistletoe in a forest depends on management objectives. A component of mistletoe helps a forest by providing habitat for birds that often feed on insect pests. An excess of mistletoe destroys habitat, impairs timber production, and makes the forest vulnerable to costly wildfires. Through careful planning, the detrimental effects of mistletoe can be balanced with habitat needs.

The most practical treatments for mistletoe are practices that adjust forest stocking, composition, and structure. Treatments are applied during stand management activities, specifically regeneration, thinning, and harvesting.

The strategy for managing mistletoe in stands allocated to timber production is simple:

- Prevent new infections following harvest
- Favor non-host alternate species
- Shift stand structure toward evenness

Even-aged harvesting techniques such as clearcutting, seedtree harvesting, and shelterwood harvesting are essential if mistletoe is to be eliminated. Uneven-aged management such as singletree selection and group selection (small patch harvests) perpetuate mistletoe in infected stands. Natural barriers to seed spread such as roads, ridgetops, meadows, and non-susceptible areas of forest should be utilized when planning harvest boundaries in mistletoe-infected forests.

Clearcutting followed by killing all remaining infected trees effectively eliminates mistletoe before new seedlings are established. In seedtree and shelterwood harvesting, select uninfected or only lightly infected (DMR less than 2) trees for seed and shelter. Harvest or kill the diseased overstory before susceptible seedlings are 10 years old, or before seedlings are 3 feet tall, or before seedling height exceeds average snow depth to protect the new crop of trees from infection.

Harvest plans that require leaving legacy trees, seed trees, or shelter trees may perpetuate mistletoe. Plant or favor alternate non-host species beneath infected overstory trees.

Mistletoe infected trees along the border of harvested areas can infect the new forest if host tree species are regenerated. To prevent or slow mistletoe infection, plant or manage for non-susceptible species in a buffer zone at least 50 feet wide around the perimeter of the harvest area. Host trees arising from natural seeding near the harvest boundary can be removed during thinning.

Square or “regular” shaped harvest areas larger than 20 acres help slow mistletoe infection. Harvest units smaller than 20 acres may be infected rapidly by diseased pine and larch. Avoid long and narrow or irregularly shaped harvest units where infected border trees remain, or plant alternate species to mitigate infection risk.

Thinning is best applied in lightly infected stands (DMR 1 or 2). Crop trees should be mistletoe free, but lightly infected trees may be retained to meet stocking objectives. Retain non-host trees in mixed species stands.

Moderately infected trees and stands (DMR 3) may further decline after thinning if an abundance of infections are stimulated. Thinning is probably not a good investment if the average stand DMR exceeds 3 for remaining crop trees. Continue to grow the stand and replace it as soon as possible.

Thinning may trigger latent mistletoe infections. The concern is greatest in dense pre-commercial size timber. Examine the stand within 5 to 10 years following thinning for newly visible infections that were latent. Avoid thinning small trees to crop tree spacing until latent infections are identified in stands expected to have an abundance of infection.

Mistletoe Management and Wildlife Habitat

Saving mistletoe infected trees for wildlife is most workable in mixed species stands. Host-free buffers are used to isolate infected trees. In single species stands, buffers must be free of trees. Buffer width is roughly equal to the average maximum mistletoe seed shooting distance. A common standard recommends retaining one severely infected tree or clump of trees per 5 acres for wildlife habitat.

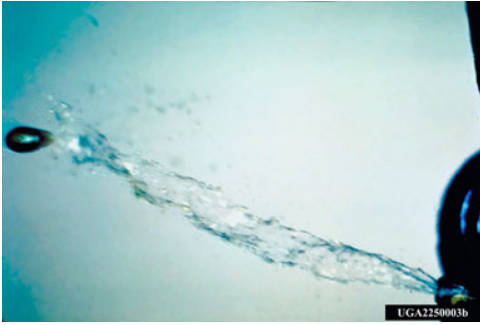
Infected Douglas fir, ponderosa pine, and western larch are the preferred species to save for mistletoe related habitat. Witches’ brooms on Douglas fir tend to be large and dense providing good cover for hiding, roosting, and nesting. Witches brooms on ponderosa

pine are not as dense, but provide useful habitat, too. Mistletoe infected larch shed limbs providing long standing hard snags ideal for cavity nesting birds.

Mistletoe infected Douglas fir can be saved for wildlife by isolating the infected tree (or clump of trees) with a buffer zone 20 feet wide measured from the crown edge of the diseased tree. Host free buffer zones must be 30 to 50 feet wide for isolating pine and larch.

Alternate non-host species can be retained or planted within the buffer zone. During thinning, selectively remove host species that invade the buffer zone to keep the disease spread pathway interrupted.

Another good strategy is to selectively leave mistletoe infected wildlife trees where the rate of disease spread is relatively slow. For example, leave diseased trees at the base of a slope rather than near the top. Diseased trees overlooking talus or at the edge of meadows are ideal for retention. Riparian areas are good places for mistletoe infected leave trees, too.



Tiny lodgepole pine mistletoe seed powered by water pressure may “shoot” up to 30 feet.



Small, inconspicuous Douglas fir mistletoe plants are difficult to detect. Seed dispersal distance seldom exceeds 10 feet.



Large, showy ponderosa pine mistletoe plants are easily detected. Large plants disperse seed up to 50 feet.



Stem infection by western larch mistletoe may kill this sapling.



Huge Douglas fir mistletoe witches' brooms provide excellent hiding cover and nest sites. Note the thinning foliage above the highly flammable brooms. Mistletoe will kill this tree.



Douglas fir killed by severe mistletoe infection.



Western larch heavily infected by mistletoe. Old infected larch branches, brittle with decay, break off under snow loading creating a hard long-standing snag useful to wildlife.



Dead ponderosa pine displaying skeletons of witches' brooms. Bark beetles killed these heavily infected trees, weakened by mistletoe.



Layered stand of lodgepole pine infected with mistletoe. The understory juvenile trees are infected by mistletoe shed from the overstory and are no longer suitable for replacement trees.



Mistletoe infected Douglas fir trees in a shelterwood harvest. The infected overstory trees, unless removed, will infect juvenile Douglas fir in the understory.



Thinning or partial cutting in lodgepole pine infected with mistletoe does little to stop or suppress disease spread.



Fire—the natural process for controlling mistletoe. This fire is burning infected lodgepole pine.