

# Hemlock Dwarf Mistletoe Stand Establishment Decision Aid

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## Introduction

Hemlock dwarf mistletoe (*Arceuthobium tsugense*), a parasitic seed plant, is endemic and common in coastal western hemlock forests from northern California to southern Alaska. The mistletoe spreads by seeds dispersed from residual to nearby trees. Over time, infestations can significantly reduce tree growth. Annual growth losses attributed to mistletoe infection are estimated at over 1 million m<sup>3</sup> in coastal British Columbia. Variable retention silviculture regimes recently implemented in hemlock-dominated coastal forests create conditions that could exacerbate the spread, intensification, and effects of mistletoe.

The Stand Establishment Decision Aid (SEDA) format has been used to extend information on various vegetation and forest health concerns in British Columbia. This is the second SEDA produced for the Coast Forest Region. It summarizes information that relates current management regimes to the spread and effects of hemlock dwarf mistletoe. The first page provides general information, hazard ratings for the biogeoclimatic zones and subzones of the Coast Forest Region, and silvicultural considerations for hemlock dwarf mistletoe. The second page outlines the growth and yield implications and other effects and associations of the pathogen. This page also includes a valuable resource and reference list to provide readers with more detailed information. Reference material that is not available on-line can be ordered through libraries or the Queen's Printer at: [www.qp.gov.bc.ca](http://www.qp.gov.bc.ca)

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**KEYWORDS:** *stand establishment, hemlock dwarf mistletoe, silvicultural considerations, western hemlock, forest health, forest pathogen*

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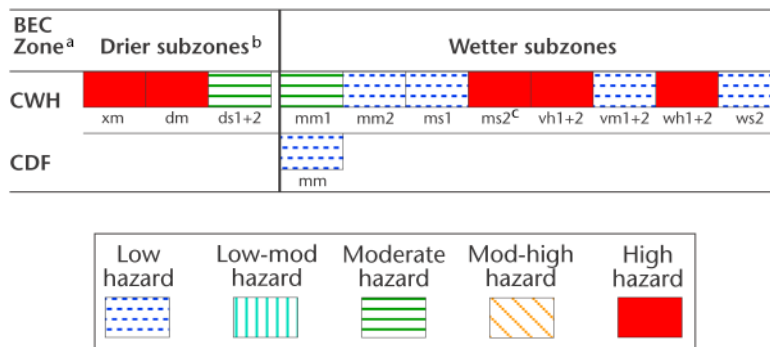


# Hemlock Dwarf Mistletoe – Coast Forest Region

B.C. Ministry of Forests, Forest Practice Branch



## Hazard Rating



<sup>a</sup> See Meidinger and Pojar (1991) for an explanation of Biogeoclimatic Ecosystem Classification (BEC) zone, subzone, and variant abbreviations.

<sup>b</sup> Some shore pine may be infected with hemlock dwarf mistletoe in these subzones.

<sup>c</sup> Although this subzone is found from sea level to 700 m elevation, the hazard for western hemlock dwarf mistletoe is only high up to 600 m. Hazard above 600 m elevation is low.

## General Information

Hemlock dwarf mistletoe is scattered, but almost ubiquitous in coastal western hemlock forests. Infections are discrete, located above-ground, and recognizable with training.

Infection is characterized by aerial shoots of the dwarf mistletoe on swollen branches or stems and initiation of new branches that extend to form a dense, fan-shaped cluster of branches (“witches’ broom”). Infection produces numerous large brooms and stem swellings, particularly on older immature to mature infected trees. In dense stands, dwarf mistletoe shoots are present only on swellings and brooms located in the upper, well-exposed portion of the tree crown.

Infection, as indicated by trees with dense or rounded crowns, often occurs in patches or gaps. However, this branching can be confused with dense adventitious branching that often occurs on injured trees adjacent to roadways or clearings.

With limited dispersal of seed from mistletoe berries, infection of young trees occurs only within 10–15 m of residual infected trees. Infection of young trees depends on the proximity and length of time trees are exposed to mistletoe seed from residual infected trees. Generally, young trees must be 2 m or taller, or 10 years or older, before a significant amount of infection is evident.

The effect of hemlock dwarf mistletoe on individual trees is predictable by the tree’s infection rating and research on stem analyses. Stem growth will be significantly reduced when a minimum of 50% of the tree’s branches are infected (Dwarf Mistletoe Rating [DMR] of 3 or more).

Any infected tree left after disturbance or harvesting poses a risk of infection to regenerating new stands. Therefore, cutblock layout should minimize the number and distribution of residual infected trees.

## Harvest and Silviculture Considerations

**Hosts:** Western hemlock, shore pine

### Establishment/Regeneration

- Plan cutblocks to minimize or avoid leaving residual infected trees along boundaries and in dispersed or aggregate reserves.
- Remove or kill as many residual infected trees as possible, particularly any that are 3 m or taller in cut-over areas.
- Plant with non-susceptible tree species to reduce future mistletoe spread.
- Establish dense stands to slow the spread and more rapidly shade out infections.
- Genetically resistant trees have been identified, but resistant planting stock is not yet available.

### Plantation Maintenance

- At the free-growing assessment, any susceptible tree situated within 10 m of an overtopping residual tree is not acceptable.
- During brushing or spacing, cut out any infected residual trees.
- Maintain dense stands near infected retention trees to suppress mistletoe shoots and seed production.
- Encourage and maintain mixtures of less-susceptible or non-susceptible tree species.
- Maintain individual high-value trees in recreation sites by pruning all lower infected branches and large brooms, but do not remove more than one-half of the live crown.
- Monitor infection in free-growing stands using a designed sampling and plot measurement protocol. Dwarf mistletoe monitoring can be tied to other monitoring activities such as a licensee certification monitoring plot program.
- Monitoring results should be evaluated and damage criteria revised (if necessary) to reflect rates of dwarf mistletoe spread, intensification, and potential impacts.



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## Growth and Yield Implications

- An infected tree's resources are diverted to points of dwarf mistletoe infection. This can reduce tree height, diameter growth, and tree vigour, and increase susceptibility of infected trees to other forest health agents.
- Stand history and dynamics of stand growth strongly affect the spread and growth of hemlock dwarf mistletoe.
- Growth models (e.g., western hemlock dwarf mistletoe Tree and Stand Simulator [TASS] model extension is under development) can be used to evaluate the advantages and disadvantages of retention harvesting and silviculture regimes in mistletoe-infected stands.
- Growth loss is directly correlated to the number and size of infections, and moderate to severe infection in the upper crown.
- The effects of dwarf mistletoe infection on tree growth are not evident until trees are at least 20 years old. In a planted, experimental trial, stem-sectioning indicated that the most severely infected trees had significantly reduced height, but not diameter growth rates, when compared to lightly or uninfected trees.
- Older, immature infected trees (60–90 years old) can have significant growth reductions. Where one-half or more of the branches in the live crown are visibly infected, trees can have growth reductions of 20–40%.
- Moderately to severely infected trees in the dominant or co-dominant crown classes have an initial period of growth suppression of 20–70 years or more. Many of these trees were likely infected while growing under infected trees.
- In young, dense stands on medium to good, relatively level sites with no overhead sources of infection, trees appear able to grow in height faster than the mistletoe can spread vertically. As a result, these trees may experience very little (if any) growth reduction from mistletoe.
- Infected trees generally have low wood quality and may be unsuitable for lumber because of swollen stems and increased knot size.

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## Other Effects and Associations

- Stem defects (due to swellings and wood decay) and large witches' brooms create risks in parks and recreational areas. Infected branches and stems appear more susceptible to breakage and failure.
- Failure of large, older immature and old-growth infected trees creates gaps or openings that are often re-occupied by regenerating western hemlock which becomes infected by dwarf mistletoe.
- Many animals and birds forage, perch, and (or) nest on witches' brooms, but in British Columbia most associations appear casual and not closely dependent on dwarf mistletoe. In western Oregon, the marbled murrelet (a red-listed species in British Columbia) uses patches of mistletoe-infected trees in immature or second-growth western hemlock forests for nesting platforms; however in British Columbia only 7 out of 40 nests were found on mistletoe-infected branches.
- The caterpillar stage of the red-listed Johnson's hairstreak butterfly feeds exclusively on aerial shoots of hemlock dwarf mistletoe. Caterpillars closely resemble dwarf mistletoe shoots and actively feed in winter to early spring. Butterflies generally inhabit only the upper crowns of hemlock dwarf mistletoe-infected trees and are therefore difficult to find.

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