



FOREST
HEALTH

Common Insects and Diseases of Western Hemlock

Trees play an important aesthetic and biological role in our environment.

Trees such as western hemlock can suffer from a wide variety of native and introduced pests. This guide is intended to help non-specialists recognize common ailments of western hemlock and diagnose the likely cause. Using this guide, you may be able to determine an appropriate treatment for your tree or more accurately describe the problem to a tree care professional.

How to Recognize Western Hemlock

Western hemlock (*Tsuga heterophylla*) is an evergreen tree that may reach 50 m in height. It is found typically along both the east and west sides of the Coast Range and the Interior wet belt west of the Rocky Mountains. It has a narrow crown with a characteristically drooping top. It has delicate, feathery foliage and down-sweeping branches. The needles are not found in bundles; they are nearly flat, blunt at the tip, and unequal in length. The glossy upper surface of the needles is pale to dark green, and whitish underneath. This tree bears numerous small seed cones that start out green and turn brown with age. It is tolerant of shade and may grow well under mature trees.



Bark of a young western hemlock.



Bark of a mature western hemlock.

Insects and disease can afflict all portions of the western hemlock: needles, bark, woody tissues, and roots.

Where's the Problem?

Foliage or branches affected:

Foliage discoloured or absent. Frass or webbing present...**see defoliating insects**



Insects that feed on needles are called **defoliators**. Caterpillars, the pre-adult form of butterflies, moths, and sawflies, are common defoliators. Severe infestations can strip a tree of most of its foliage.

Foliage discoloured or mottled. Small bumps or blisters on leaf surface ...**see foliar problems**



Symptoms of **foliar problems** are chlorosis or discoloration, spotting, or dropping of needles. These symptoms can be caused by needle miners, or conifer rust fungi. Most foliar problems do not endanger tree survival.

Twigs covered with small, cottony tufts...**see foliar problems/adelgids**.....



Dwarf mistletoes produce conspicuous swellings of branches and growth of aerial shoots.

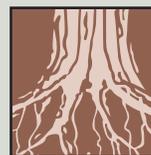
Whole tree affected (declining):

Mature tree
Tree declining with wounding of trunk or branches ...**see porcupines**



Porcupines damage and sometimes kill trees by feeding on the cambium in the winter

Tree any age
Gradual thinning of crown and yellowing foliage...**see root diseases**



Root diseases are caused by fungi. Roots that become infected will gradually die. Over several years, infected trees will weaken. Trees may also blow down more easily because the root system becomes unstable.

Main stem affected:
Conks (bracket fungi) visible on stem...**see wood decay fungi**



Wood decay fungi survive on the woody tissue of trees and cause decay in the heartwood and sapwood.



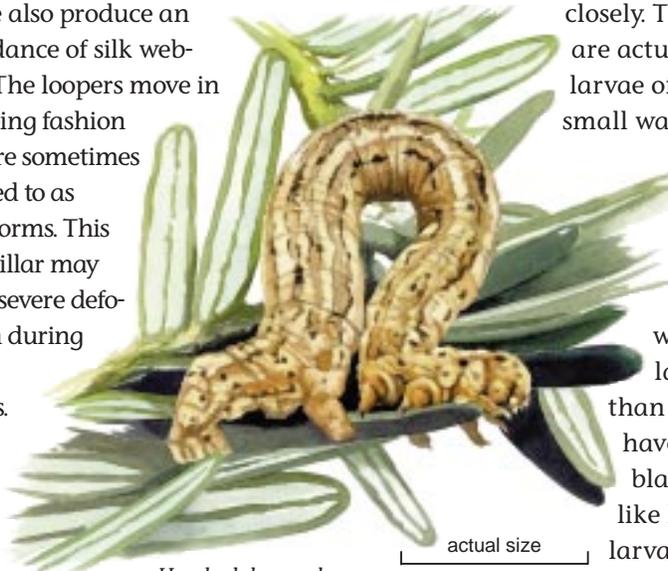
Abiotic problems are caused by the elements and may damage or kill trees.



Defoliating insects

Defoliators are insects that feed on the needles or leaves of trees. Caterpillars, the pre-adult or larval form of butterflies, moths, and sawflies are common foliage-eating pests of conifers, including western hemlock. Symptoms of damage include discoloration or loss of foliage (in general, from the top of the tree downward and from branch tips inward); chewed needles on the tree or ground; silken webbing; frass (insect droppings) accumulations under the tree; and abundant caterpillars, pupae, pupal cases, or adult moths. Western hemlock is relatively intolerant to defoliation compared with other tree species. However, in wetter coastal areas, it tolerates defoliation much better.

Hemlock looper larvae are hairless caterpillars. Mature larvae are yellowish brown to light grey with an intricate pattern of dark markings. These caterpillars are wasteful feeders and may only partially chew needles or sever needles at the base, leaving them to accumulate under the tree. Mature larvae also produce an abundance of silk webbing. The loopers move in a looping fashion and are sometimes referred to as inchworms. This caterpillar may cause severe defoliation during outbreaks.



Hemlock looper larva.

Although primarily a pest of Douglas-fir, **silver-spotted tiger moth larvae** may also defoliate hemlock.

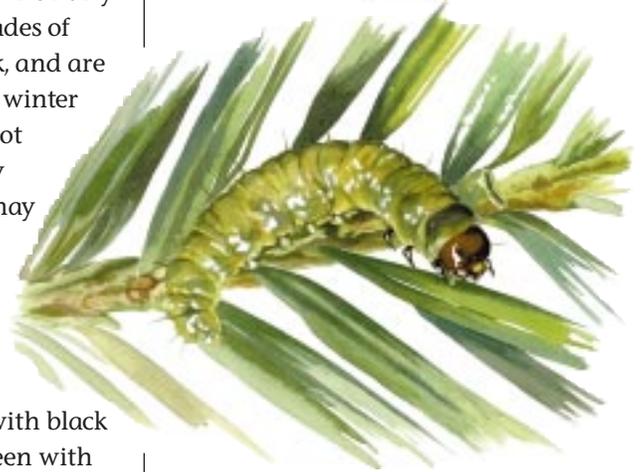
Young caterpillars feed in colonies, and form loose tent-like webs containing dead needles and frass near the ends of branches. Individual branches are attacked. When the larvae are nearly full-grown they disperse and feed individually. The hairy caterpillars are tufted in shades of red-brown, yellow, and black, and are usually first detected in late winter or early spring. Damage is not severe and branches usually recover. Affected branches may be clipped and burned.



Silver-spotted tiger moth larva.

actual size

The **western blackheaded budworm** feeds on the needles of opening buds. Young caterpillars are pale green with black heads and turn a darker green with brown heads as they mature. Needles are usually only partially eaten or clipped, and are often webbed together on the twigs by these caterpillars. Impact may be severe during outbreaks, especially to immature trees.



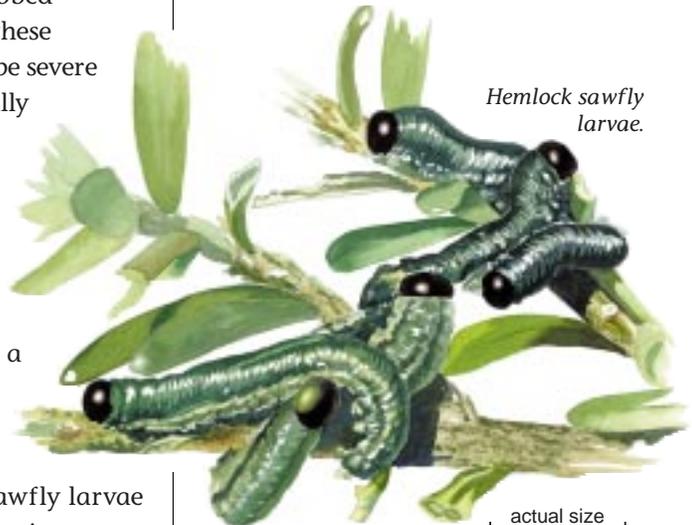
Western blackheaded budworm

actual size

Hemlock sawfly larvae resemble caterpillars except when examined

closely. They are actually larvae of a small wasp.

Sawfly larvae have six or more leg-like appendages whereas caterpillars have fewer than six. They also have characteristic black, shiny, button-like heads. These larvae are wasteful



Hemlock sawfly larvae.

actual size

feeders of older foliage and leave tufts of new needles on the branch or twig ends. The larvae often feed in groups. Sawflies rarely cause tree death; however, they may kill tree tops and cause growth loss. Mortality may increase if attack occurs in successive years or in conjunction with other

defoliators such as the western black-headed budworm. Mature larvae spin capsule-like, papery cocoons that can be found in the foliage or at the base of the tree.

Defoliator populations usually cycle between high outbreak levels and very low numbers. Populations are controlled naturally by the combined action of predators, parasites, disease, weather conditions, and food availability. Application of an insecticide to control these pests may be warranted, especially to protect special or high-value trees. Consult a specialist prior to applying any insecticide.



Foliar problems

The **hemlock woolly adelgid** is a small aphid-like insect. It produces a white cottony tuft under which it hides. Tufts may be found on the bark and on twigs between the needles of hemlock trees of any age.

Damage is not usually significant, except on seedlings; however, this insect may be aesthetically displeasing. High numbers of this insect are often an indication that the tree is under environmental stress. Watering affected trees during dry periods and applying fertilizer at the base of trees may alleviate some of these stresses. Insecticides registered and recommended for aphids are usually effective. Consult a specialist prior to treatment.



Juvenile hemlock woolly adelgid (*Adelges tsugae*) on hemlock needle.



White cottony tufts of hemlock woolly adelgid (*Adelges tsugae*) on hemlock needle contain females with eggs.

Another common foliar problem is caused by the **hemlock-blueberry rust**. This rust infects individual needles on young trees, causing them to discolour and shed prematurely. Check affected needles for small, yellow-orange bumps on the underside. This disease is common, especially in areas where hemlock is in close



Aecia on the lower needle surface resulting from hemlock-blueberry rust infection.



Discoloured hemlock needles resulting from hemlock-blueberry rust (*Naohidemyces vaccinii*) infection.

proximity to blueberries, huckleberries, or lingonberries. The underside of leaves from these shrubs may also develop yellow-orange spots. Damage is not usually fatal.



Hemlock dwarf mistletoe

Dwarf mistletoes are plants that parasitize a living host tree, robbing it of nutrients and water. This pest infects trees of any age but is quite host-specific, preferring only a few species.

Hemlock dwarf mistletoe primarily affects western hemlock but can occasionally attack mountain hemlock, amabilis fir, subalpine fir, Sitka spruce, and lodgepole pine (shore pine) on the coast. Hemlock dwarf mistletoe does not occur east of the Coast Mountains.



Hemlock dwarf mistletoe aerial shoots on a swollen branch.

Dwarf mistletoe plants develop from a germinating seed that penetrates the bark, usually on a branch. Plant shoots are perennial and green, and are approximately 8 to 12 cm long.



Abnormal branch clumps can be easily recognized and are often referred to as witches' brooms.

In the fall, green berries containing sticky seeds are produced. Dwarf mistletoe seeds are explosively ejected from the berries and may travel up to 12 meters, landing on nearby branches or stems to cause new infections.

Infection by this parasitic plant induces swelling of the bark and wood at the point of infection and stimulates the excessive growth of branches. These abnormal branch growths can be easily recognized and are often referred to as witches' brooms.

Severely infected trees should have infected branches pruned because dead or heavy live branches may break easily, posing a safety threat. Pruning infected branches may improve the health of a tree and lengthen its life. Since the seeds from an infected tree spread up to 12 m laterally, susceptible trees in that zone are at risk. Seeds from tall trees may rain down on younger ones underneath, severely impairing their growth. If replacing infected trees in an area, plant with non-susceptible species such as Douglas-fir, pine (except lodgepole), cedar, or broadleaf species.



Porcupine

The porcupine may be found throughout the province except Vancouver Island, the Queen Charlotte Islands, and other coastal islands. Porcupines gnaw the bark of trees in the winter and may kill the tree if the lower portion of the stem is girdled. Top kill, deformities, and a reduced growth rate may result from non-lethal feeding damage.

American porcupine (Erethizon dorsatum)

Gnawing and girdling of the lower stem occurs more commonly in young trees, while debarking of the upper stem and branches usually occurs on older trees. The sapwood is usually gnawed and horizontal



Porcupine damage

tooth marks approximately 2.5 cm wide can be seen when examined closely. Often small strips of bark and branch cuttings may be found under the tree. Droppings may also be found at the base of a newly attacked tree. Porcupine droppings are about 2.5 cm long, narrow and curved with rounded edges. They may be found singly or linked in chains. Porcupines may be difficult to discourage.



Wood decay fungi

Bracket fungi (or conks) may survive on the woody tissue of trees and cause decay in the heartwood and sapwood. These decay fungi may gain access to the interior of the tree stem via wounds, broken or dead branches, or the roots.

Wood decay is generally split into two types: **brown rots** and **white rots**. Brown rots darkly stain the wood, which eventually degrades into a brittle, cube-like structure. White rots cause lighter staining and the



Brown rot – This cube-like type of wood decay is typical of most brown rots.



White rot – This pitted type of decay is common to many white rots.

wood becomes pitted or mottled, eventually turning stringy or spongy.

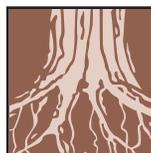
Decay fungi normally develop slowly and it may be decades before conks appear. The presence of conks on the stem usually indicates that decay is well-advanced. It should be assumed that the wood has sufficiently deteriorated to the point where the tree may be structurally unsound and the stem subject to breakage.

Carpenter ants are often associated with decaying wood.



Indian paint fungus (Echinodontium tinctorium) sporophore associated with a dead branch.

An example of a common wood decay of western hemlock is caused by *Echinodontium tinctorium*, often referred to as **Indian paint fungus**. This decay produces a conk at the base of a dead branch. The conk is easy to identify as the underside consists of a cluster of long spines or “teeth.” These spines, when broken, display a distinct rust-red interior.



Root diseases

Root diseases are a group of fungi that attack healthy tree roots, interrupting the flow of water or nutrients to the crown,

causing a decline in tree vigour. Usually, young trees die more quickly than older ones. Living infected trees may blow over because their root system is structurally weakened. Root diseases primarily spread by contact between infected roots and neighbouring uninfected roots. Depending on the root disease, the roots of dead trees and stumps may remain infectious for many years.

Infected trees may show one or more of these symptoms: yellowing or thinning foliage; gradual shortening of leader growth (“rounding” of the crown); or a heavy crop of smallish cones. Infected trees that are wind-thrown usually have small root balls with few remaining fine roots. Additional signs and symptoms are specific to the root disease.



Annosus conk.

Annosus root disease, caused by *Heterobasidion annosum*, produces a fruiting body that is usually found at the base of dead trees or inside rotted stumps. These fruiting structures are cream-coloured, button-shaped mounds on roots below the forest floor or bracket-type conks usually found inside hollowed stems.

Cream-coloured pustules usually occur on the roots above and below the ground. Internal signs may include a reddish water-soaked appearance to the heartwood. Advanced wood decay appears as a white spongy rot with black flecks.



Abiotic problems

Western hemlock, due to its shallow rooting habit, is often prone to suffer from **windthrow** or **drought**. While the results of excessive wind are obvious, drought is more difficult to recognize because the effects may not appear until the following year – far too late for corrective action.



Drought damage.

Drought-stressed trees will usually drop all or a part of their foliage the spring following a dry summer, often with little colour change. This will be more common in areas where hemlock is a marginal species to start with – the drier parts of the coast and interior. Juvenile trees and those growing on rocky or porous soils will suffer the most.

Frost cracks appear as long, black vertical scars in the bark of older trees. These cracks occur when the temperature drops rapidly, contracting the

bark and splitting it. These wounds then create callus tissue, which fills the crack and gives it a darker appearance. These wounds may act

as entry points for some wood decay fungi. This feature is quite common on hemlock in the forest and there is little that can be done to prevent it.

How Can I Control These Pests?

These general guidelines indicate how to deal with specific pests. Consult a specialist before using any insecticide.

Western hemlock may be killed if severely defoliated by caterpillars. In this case, an application of an approved insecticide may be warranted, especially to protect special or high-value trees.

Damage caused by **adelgids** will rarely need to be treated because it is usually not significant except on seedlings or small saplings. Insecticides that are registered and recommended for aphids are usually effective if they are applied when the adelgid is first noticed (spring to early summer). Follow label directions.

Foliar problems caused by **conifer rusts** may be aesthetically displeasing but are rarely fatal.

Porcupines can be prevented from feeding on trees by inhibiting their ability to climb. Place a slick-surfaced (i.e., metal or smooth plastic) collar around the base of the tree. Some commercial predator-odour products may also discourage porcupines. If the problem persists, contact your local Conservation Officer Service for advice.

Spread of **dwarf mistletoe** seed can be prevented by removing aerial shoots when they appear and pruning infected branches. Avoid planting or allowing susceptible smaller trees to grow under taller infected ones. Since dwarf mistletoes are quite host-specific, choose species that are not subject to infection.

When **bracket fungi**, or **conks**, appear on a tree, it usually indicates well-advanced internal decay. The wood will have deteriorated to the point where the tree may be structurally unsound, causing the stem to break. Remove affected trees, as they pose a safety hazard.

Few options are available to treat trees afflicted with **root disease**. Remove any infected dead or dying trees from the area, as they will pose a hazard to humans and property if they fall. Ideally, also remove the infected stumps because they can harbour the fungi for many years, and will spread the disease to newly planted western hemlock or other susceptible neighbours.

Drought may be avoided by ensuring that young trees, or those growing in porous soils, receive adequate water during prolonged dry spells. It is better to water deeply but infrequently in order to promote more extensive root growth.



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Prince George Forest Region,
1011 Fourth Avenue,
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Nelson Forest Region,
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Kamloops Forest Region,
515 Columbia Street,
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(250) 828-4131

Cariboo Forest Region
200-640 Borland Street
Williams Lake, B.C. V2G 4T1
(250) 398-4345

Or via Enquiry BC:

- Vancouver – 1-800-660-2421
- Victoria – 1-800-387-6121
- Rest of province – 1-800-663-7867

Internet contact:

Ministry of Forests – www.for.gov.bc.ca

Canadian Forest Service –
www.pfc.cfs.nrcan.gc.ca

Insect Diagnostics –
[www.forestry.ubc.ca/fetch21/
FRST308/labindex.html](http://www.forestry.ubc.ca/fetch21/FRST308/labindex.html)

