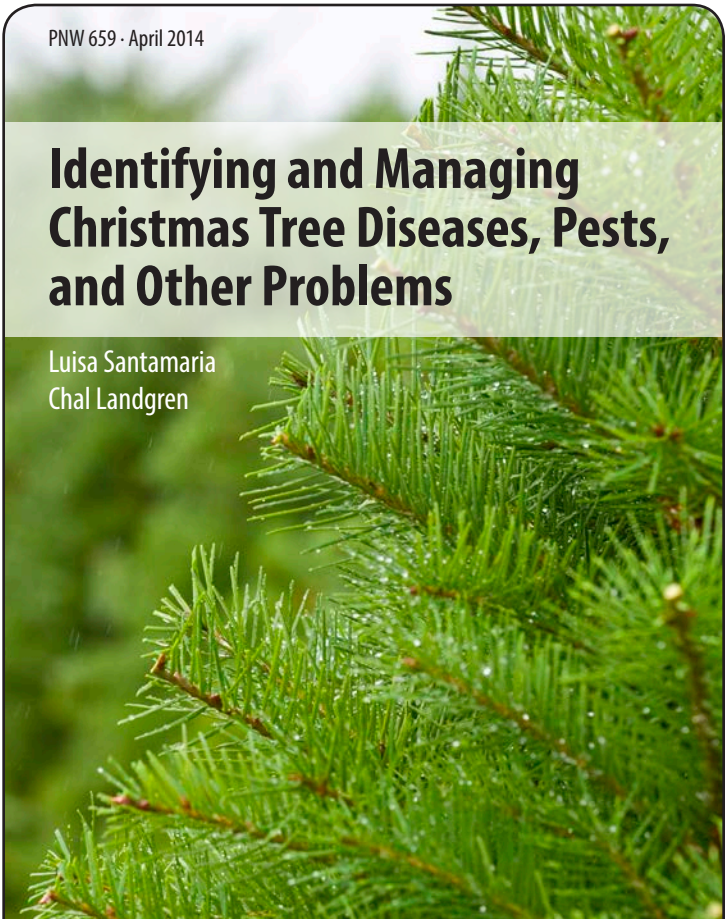
PNW 659 · April 2014

Identifying and Managing Christmas Tree Diseases, Pests, and Other Problems

Luisa Santamaria
Chal Landgren



A Pacific Northwest Extension Publication
Oregon State University · University of Idaho · Washington State University

AUTHORS & ACKNOWLEDGMENTS

Luisa Santamaria, assistant professor, Extension plant pathologist in nursery crops; and Chal Landgren, professor, Extension Christmas tree specialist; both of Oregon State University.

The authors thank the following peers for the review of these diagnostic cards and for their helpful comments and suggestions. In alphabetical order:

- Michael Bondi–Oregon State University
- Gary Chastagner–Washington State University
- Rick Fletcher–Oregon State University
- Alina Freire-Fierro–Drexel University
- Carla Garzon–Oklahoma State University
- Dionisia Morales–Oregon State University
- Kathy Riley–Washington State University
- Helmuth Rogg–Oregon Department of Agriculture
- David Shaw–Oregon State University
- Cathy E. Thomas–Pennsylvania Department of Agriculture
- Luis Valenzuela–Oregon State University

This project was funded by the USDA Specialty Crop Block Grant program (grant numbers ODA-2577-GR and ODA-3557-GR).

TABLE OF CONTENTS

Diseases

Insects

Disorders

Damage (Weather)

Damage (Chemical)

Damage (Vertebrate)

Damage (Mechanical)

Annosus Root Rot
(Heterobasidion root rot)
Heterobasidion annosum

Signs & symptoms

- Declining leader growth
- Dark, irregular-shaped staining in the center of cut trees
- Dead trees near old stumps
- Small white mounds (fungus) on the bark near ground line

Where to look

- Fields after multiple rotations without stump removal
- Trees planted near stumps

Similar symptoms as

- Other root and canker diseases
- Drought

Annosus Root Rot

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
				SYMPTOMS							
										MONITOR	
		MANAGE - 1								MANAGE - 2	

Declining growth, yellowing, dead trees (most likely during moisture stress)

Examine stumps at harvest season.

1 Remove stumps. 2 Treat stumps at harvest.

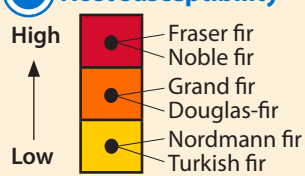
Scouting

- Examine stumps of harvested and dead trees.

Management options

- Consider stump removal prior to replanting.
- Treat freshly cut stumps of healthy trees with borax (Sporax) to prevent infection by windborne spores.
- Plant resistant species.

Host susceptibility



Phytophthora Root Rot

Phytophthora spp.

Signs & symptoms

- Reduced or stunted growth
- Poor color
- Root decay
- Bleeding basal cankers
- Dead branches first noticeable at the base of the tree

Where to look

- Low-lying areas with poor drainage

Similar symptoms as

- Other root diseases
- Drought

Phytophthora Root Rot

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			SYMPTOMS								
			MONITOR								
	MANAGE - 1							MANAGE - 2			

Dying, yellowing trees; trees with cankers

Scout for especially off-color trees with dead branches and wet areas.

1 Plant resistant species. 2 Improve drainage.

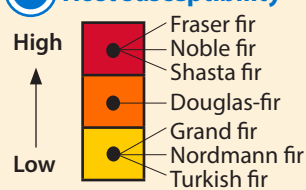
Scouting

- Cut the tree and check cambium for presence of canker.
- Dig roots and check for dark and rotten roots.
- Look for dead trees in field.
- Look for flagging branches.

Management options

- Replant with resistant species.
- Improve field drainage (e.g., tiling, ditches).
- Avoid sites with poorly drained soils.

Host susceptibility



Grovesiella Canker

Grovesiella abieticola

Signs & symptoms

- Pronounced cankers, often accompanied with over-growth and thickening
- Cankers associated with off-color/dead branches on the tree
- Round, gray-black fruiting bodies (1.6 mm, produced by fungus) within the canker

Where to look

- On branches between dead and living wood
- Lower part of tree

Similar symptoms as

- Phytophthora root rot and stem canker
- Environmental stress
- Chemical damage

Grovesiella Canker

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			SYMPTOMS								
				MONITOR							
			MANAGE								

- Dead branches with overgrowth (most likely during moisture stress)
- Check off-color/dying branches.
- Remove and destroy infected trees.

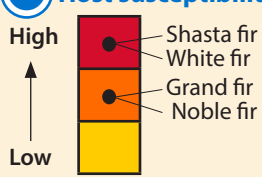
Scouting

- Search for slightly sunken dead tissue and cankers on dying branches.
- Look for overgrowth.

Management options

- Cut and destroy trees exhibiting symptoms.
- Do not replant near infected trees.

Host susceptibility



Interior Needle Blight

Several fungi species: *Mycosphaerella* spp., *Phaeocryptopus nudus, Phyllosticta abietis, Toxosporium* spp., *Rhizosphaera*

Signs & symptoms

- Random to complete browning of older needles, mostly on lower branches
- Symptomatic needles initially remain firmly attached to the branch
- Small, black fungal fruiting bodies present on the undersides of needles
- Limited to true firs

Where to look

- Older, dense trees
- Areas with poor air circulation

Similar symptoms as

- Environmental stress
- Drought
- Interior needle loss
- Nutrient imbalances

Interior Needle Blight

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
							SYMPTOMS				
								MONITOR			
				MANAGE							

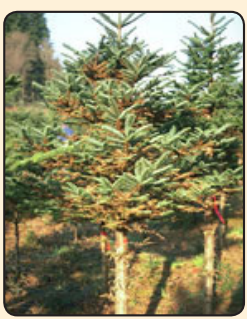
Older needles dead but still attached

Check lower branches.

Use fungicides to protect new growth.

Scouting

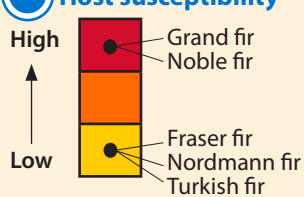
- Observe trees in weedy, crowded sites.
- Observe areas near timber.



Management options

- Promote better air circulation within plantations.
- Improve weed control.
- Conduct basal pruning.
- Spray protective fungicides, if needed (multiple years).

Host susceptibility



Rhabdocline Needle Cast

Rhabdocline spp.

Signs & symptoms

Before bud break:

- Reddish-brown spots on upper surface of current-year needles; distinct border between diseased area and healthy green tissue
- Swollen, elongated, light-tan fruiting bodies on the underside of symptomatic needles

During bud break:

- Fruiting bodies rupture underside of needle, releasing a mass of spores.

Where to look

- Douglas-fir sources from east of the Cascades

Similar symptoms as

- Cooley spruce gall adelgid
- Swiss needle cast
- Douglas-fir needle midge
- Rust

Rhabdocline Needle Cast

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	SYMPTOMS										
		MONITOR									
				MANAGE							

Current needles with reddish-brown spots

Check underside of needles for fruiting bodies.

Use fungicides to protect emerging needles.

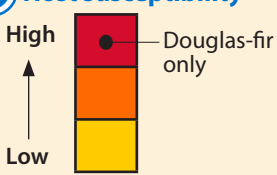
Scouting

- Search for symptoms prior to bud break, in late winter or very early spring.
- Look for reddish-brown splotches on the upper needle surface. Only the newly emerging spring growth can become infected.

Management options

- At bud break, spray fungicide (if needed) to prevent infection.
- Remove and destroy severely infected trees prior to bud break.
- Plant resistant or tolerant tree varieties; avoid Douglas-fir from Rocky Mountain seed sources, unless tested.

Host susceptibility



Swiss Needle Cast

Phaeocryptopus gaeumannii

Signs & symptoms

- Parallel rows of tiny, black fruiting bodies on the underside of older needles
- Yellowing or mottling of infected needles
- Loss of interior needles; thin appearance of trees

Where to look

- Areas with poor air movement
- Field edges near Douglas-fir timber

Similar symptoms as

- Rhabdocline needle cast
- Cooley spruce gall adelgid
- Environmental stresses
- Nutrient imbalances
- Winter burn
- Drought damage

Swiss Needle Cast

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	SYMPTOMS										
		MONITOR									
				MANAGE							

- Older needles yellow; fungal structures present
- Check underside of needles for black fruiting bodies.
- Use fungicides to protect new growth.

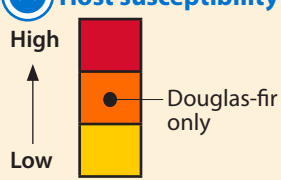
Scouting

- Using a hand lens, look for parallel bands of tiny, black structures (0.1 mm) arising from the stomates on the undersides of affected needles.
- Start scouting when trees enter their third growing season, beginning in May.
- Look at older needles in the lower part of the tree.
- Pay particular attention to trees that appear off-color or thin.

Management options

- Improve air circulation in fields.
- Spray protective fungicides (if needed) between bud break and 3.8 cm of new growth.
- Plant alternative tree species.
- Avoid planting field edges near timber.
- Remove and destroy heavily infected trees prior to bud break.

Host susceptibility



Melampsora Needle Rust

Melampsora occidentalis

Alternate hosts: black cottonwood, aspen, and hybrids of *Populus* spp.

Signs & symptoms

- Slight yellowing on infected newly emerging needles
- Cream to yellow fruiting bodies 2 weeks after initial symptoms
- Discolored areas become necrotic, and the needles shrivel and shed during the following 4 to 6 weeks.
- Severely damaged shoots become cankered and die.

Where to look

- Areas near overwintered, diseased leaves of poplar or other alternate hosts

Similar symptoms as

- Chemical damage

Melampsora Needle Rust

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			SYMPTOMS								
				MONITOR							
			MANAGE								

New needles with discolored areas

Check underside of new needles for orange structures.

Use fungicides to protect new growth.

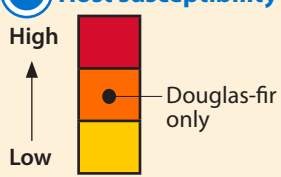
Scouting

- Watch for yellowing on newly emerged needles.
- Look for yellow-orange pustules in discolored areas of the needles.

Management options

- Spray protective fungicide (if needed) on developing shoots.
- Remove susceptible poplar hosts near Douglas-fir plantations.
- Select a less susceptible seed source.

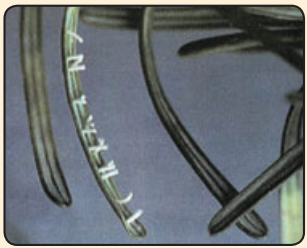
Host susceptibility



Pucciniastrum Needle Rust

Pucciniastrum goeppertianum

Alternate hosts: *Vaccinium* spp.



Signs & symptoms

- Possible yellowing areas on infected needles
- White, tube-like fruiting structures on the underside of infected needles

Where to look

- Trees near alternate hosts (*Vaccinium* spp. such as huckleberry, wild blueberry, and cranberry)

Similar symptoms as

- Current season needle necrosis
- Uredinopsis needle rust

Pucciniastrum Needle Rust

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SYMPTOMS											
					MONITOR						
				MANAGE 1			MANAGE 2				

White, tube-like structures on the underside of infected needles

Check for alternate hosts (*Vaccinium* spp.). **1** Use fungicides to protect new growth. **2** Remove and destroy alternate hosts.

Scouting

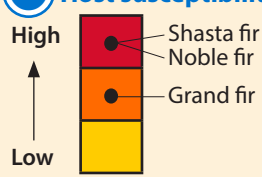
- Observe trees in areas near alternate hosts.
- Look for yellowing (often banded) on current season needles.

Management options

- Remove and destroy alternate hosts near plantation.
- Spray protective fungicides (if needed) on new developing shoots.

Alternate hosts: *Vaccinium* spp.

Host susceptibility



Uredinopsis Needle Rust

Uredinopsis pteridis

Alternate host: bracken fern

Signs & symptoms

- Yellowing blotches on the upper surface of needles
- Needles of any age vulnerable
- White, tube-like fruiting bodies on underside of needles

Where to look

- Trees near alternate host (bracken fern)

Similar symptoms as

- Current season needle necrosis
- Pucciniastrum needle rust

Uredinopsis Needle Rust

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SYMPTOMS											
				MONITOR							
				MANAGE 1			MANAGE 2				

Yellowing blotches on upper surface of infected needles

Check for tube-like structures on underside of needles.

1 Use fungicides to protect new growth. 2 Control ferns with herbicides.

Scouting

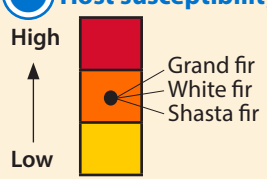
- Observe trees in areas near alternate host (bracken fern).
- Look for yellowing (often banded) on current season needles.

Alternate host: Bracken fern

Management options

- Remove and destroy all bracken ferns nearby. Pathogen depends on alternate host for survival.
- Spray protective fungicides (if needed) on developing fir shoots.

Host susceptibility



Twig Aphid

Mindarus abietinus

Signs & symptoms

- Curled, twisted needles on current year's growth
- Stunted needles
- Needle loss
- Black, sooty mold on stems, trunk, and needles
- Presence of bees and/or yellow jackets

Where to look

- Localized areas in the field

Similar symptoms as

- Various aphid species

Twig Aphid

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
					SYMPTOMS						
			MONITOR								
			MANAGE								

Needle distortion, stunting, and loss

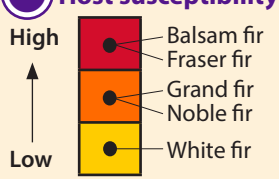
Look for presence of adults.

Spray insecticide (if needed).

Scouting

- Monitor egg hatch by late April, using a hand lens (15x). Aphids have two distinct forms: stem mother is relatively large and bluish-gray; offspring is smaller, greenish-yellow, and may be covered by a fine powdery wax.
- Scout for pale tan, oval eggs coated with wax.
- Use beating sheet or board to detect presence of adults.
- Listen for wasps and bees.
- Check for black soot on the ground.

Host susceptibility



Management options

- Encourage natural predators like lacewings, earwigs, lady beetles and their larvae, ants, predatory thrips, predaceous midges, and parasitoids such as *Aphidius* spp.
- Apply insecticide after eggs hatch. Synthetic pyrethroids may cause outbreak of secondary pests, such as eriophyid mites, due to reduction of natural predators.

Conifer Root Aphid

Prociphilus spp.

Alternate host: Ash tree (*Fraxinus* spp.)

Signs & symptoms

- General decline of trees and eventual death of the leader and branch tips
- Typically on 3- to 4-year-old trees
- Stunted young trees
- Ant activity around trunks and roots
- Clusters of white aphids on the roots

Where to look

- Localized areas in the field

Similar symptoms as

- Nutrient deficiencies
- Root problems

Conifer Root Aphid

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SYMPTOMS											
			MONITOR								
				MANAGE							

Trees declining; drastic growth reduction

Look for ants around trunks and roots.

Spray insecticide (if needed).

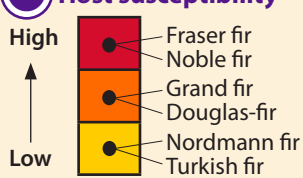
Scouting

- Scout for ants around the trunks and roots. (*Prociphilus* spp. feed directly on conifer roots and often are attended by ants. Ants may defend the aphid from natural enemies and move aphids around.)
- Dig trees and search for root aphids.

Management options

- Keep trees healthy and free of pests, disease, and cultural problems.
- Obtain seedlings from nurseries that have no root aphids.
- Use available systemic insecticides.

Host susceptibility



Conifer Aphids

Cinara occidentalis and
Cinara abietis

Signs & symptoms

C. abietis
(Giant conifer aphid)

- Easily visible
- Found feeding on the upper stems of trees, causing stunted terminals and needle yellowing
- Typically attended by ants
- Typically congregating in large colonies

C. occidentalis

- More difficult to find because they spread out
- Often feed on 1-year-old foliage on branches; as damage progresses, foliage may yellow and appear shiny from honeydew
- Ants seldom present

Where to look

- Randomly in the field
- Black "soot" in leaders
- Areas with yellow jackets

Similar symptoms as

- Other aphids

Conifer Aphids

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SYMPTOMS											
	MONITOR - 1			MONITOR - 2							
				MANAGE							

Stunting of terminals (*C. abietis*); soot on lower branches and off-color needles (*C. occidentalis*) **1** Look for overwintering eggs. **2** Look for adults.

Spray insecticide (if needed).

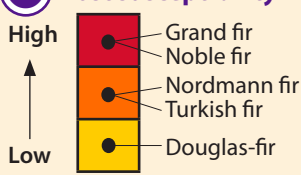
Scouting

- *C. abietis* (Giant conifer aphid) can feed throughout the year; damage may be evident any time of year. Scout for aphids in the internodal openings along the upper leaders.
- *C. occidentalis* attracts wasps and yellow jackets in the summer as the honeydew becomes more prolific. Look for damaged foliage and black soot on the ground throughout the year. These aphids are harder to spot and are dispersed along branches.

Management options

- *C. abietis* (Giant conifer aphid): Control using localized treatments, including crushing colonies by hand.
- *C. occidentalis*: Control early to avoid significant foliage damage. Use labeled insecticides for spot treatments to protect populations of natural predators.

Host susceptibility



Balsam Woolly Adelgid

Adelges piceae

(exotic pest from Europe)

Signs & symptoms

- Yellow needles and premature needle loss
- Flat top or crooked terminal
- Gouting (swelling) around buds and internodes
- Stiff, inflexible trunk and swollen lateral branches
- White, cottony masses on trunk and large branches
- Dead shoots or branches

Where to look

- Localized areas in the field

Similar symptoms as

- Root problems
- Severe aphid damage

Balsam Woolly Adelgid

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SYMPTOMS											
			MONITOR 1	MONITOR 2							
				MANAGE							

Swollen branch nodes and terminals 1 Check for eggs and cottony tufts.

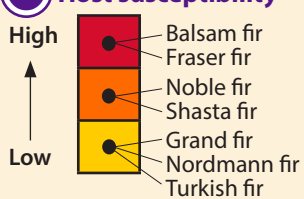
2 Check for crawlers, using a hand lens.

Spray insecticide (if needed) at/near bud break.

Scouting

- Scout at waist height for swollen areas (white, cottony masses) in branches and main trunk.
- Check flexibility of the upper stem.
- Look for poor growth of trees or affected trees that have lost flexibility in the upper stem.
- Examine stumps for reddish discoloration.

Host susceptibility



Management options

- Spray insecticides at high volume and pressure during the first generation crawler stage.
- If the adelgid is found, treat the field prior to bud break of the following season.
- Clear-cut infested blocks. Do not leave infested trees in the field, and avoid cutting during crawler activity.

Cooley Spruce Gall Adelgid on Douglas-fir

Adelges cooleyi

Alternate hosts: *Picea* spp. such as Colorado blue spruce and other spruces

Signs & symptoms

- Yellow spots on needles
- Needles with bends or crooks
- Small, white, cottony balls on the underside of needles or pepper-sized crawlers on new needles
- Premature needle drop

Where to look

- Current season needles

Similar symptoms as

- Rhabdocline needle cast
- Douglas-fir needle midge

Cooley Spruce Gall Adelgid on Douglas-fir

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SYMPTOMS											
			MONITOR								
				MANAGE							

- Yellow spots and distortion on needles
- Look for crawlers on new needles.
- Spray insecticide (if needed) before cottony stage.

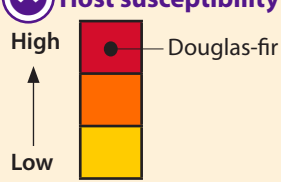
Scouting

- Examine the underside of needles for overwintering nymphs that could be covered by white wax (cottony tufts).
- Control for 2 years before harvest to have damage-free needles.

Management options

- Remove any mature spruce or Douglas-fir that may be a source of infestation.
- Use sprays when the crawlers are present and before the cottony stage occurs.
- Spot spray where problem populations are localized.
- Note: In most cases low to moderate numbers of this pest will not require control(s).

Host susceptibility



Douglas-fir Needle Midge

Contarinia spp.

Signs & symptoms

- Swollen, yellow needles where maggots are active
- After emergence of maggots, needles with possible reddish-brown appearance
- Premature needle loss

Where to look

- Sites with native Douglas-fir trees nearby

Similar symptoms as

- Rhabdocline needle cast
- Cooley spruce gall adelgid

Douglas-fir Needle Midge

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
					SYMPTOMS						
		MONITOR									
			MANAGE -1				MANAGE - 2				

Swollen, yellow needles Place emergence traps.

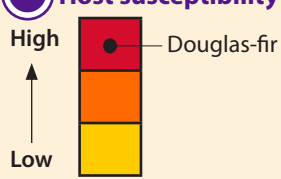
1 Apply spray control measures based on monitoring.

2 Remove infested trees.

Scouting

- By April, place emergence traps under the north side of previously infested trees.
- Place several traps per field; check frequently to detect and count the midges.
- Monitor for adult female midge emergence to effectively time spray applications.
- Check degree-day emergence models online.

Host susceptibility



Management options

- Encourage and protect natural predators.
- Remove heavily infested trees before larvae exit the needles in the fall.
- Base insecticide application on collection of adults in emergence traps or field scouting. Insecticides will be effective only against adults.
- Make first application as traps or weather dictate; often at bud swell to bud break.

Spruce Spider Mite

Oligonychus ununguis

Signs & symptoms

- Rusty or bronze colors near the base of the needles; damage possibly most severe during hot, dry weather
- Premature needle drop
- Damage heaviest at the bottom, inside of the tree
- Permanent chlorophyll loss
- Fine webbing at base of needles and twigs; cast skins, dead mites, dirt, and other debris trapped in the silk

Where to look

- Localized areas in the field
- Along dusty roads and/or where other insecticides have been used

Similar symptoms as

- Eriophyid mites
- Environmental stress
- Aphids

Spruce Spider Mite

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
				SYMPTOMS							
	MONITOR 1			MONITOR 2							
	MANAGE 1			MANAGE 2							

Foliage yellowing and bronzing

1 Look for overwintering eggs. 2 Look for active mites.

2 Spray eggs (if needed). 1 Spray miticide (if needed) for adults/immature mites.

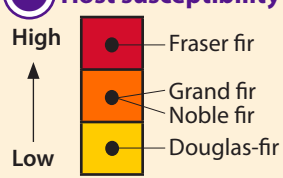
Scouting

- Use a 15-20X hand lens to view spider mites and eggs. Eggs have a single, hair-like stripe on the top, which can be used to distinguish them from other spider mite eggs.
- Look for eggs during the winter and early spring (before April).
- Look for damage about halfway up the canopy and in the interior part of the tree.
- To detect active stages, beat suspect branches above collection tools, such as paper plates or any light-colored sheet or surface.

Management options

- Based on scouting, decide whether to control.
- If eggs are found in February or March, consider an application of horticultural oil.
- Miticides typically are applied in May or early June; however, exact timing depends on scouting.

Host susceptibility



Eriophyid Mites

Trisetacus spp., *Epitrimerus pseudotsugae,* and *Nelepella ednae*

Signs & symptoms

- Bronzing and stunting of new needles, or bronzing and curling of more developed new shoots
- Needles later turn brown, die, and drop from the shoot, leaving naked branch tips

Where to look

- Localized areas in the field

Similar symptoms as

- Damage caused by environmental stress
- Other mites
- Chemical and nutrient imbalances

Eriophyid Mites

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
		SYMPTOMS									
	MONITOR 1				MONITOR 2						
		MANAGE 1						MANAGE 2			

New needles bronzing and stunting **1** Look for eggs.

2 Use a 15-20X hand lens to find adults that are spindle-shaped and smaller than other mites. **1** & **2** Spray miticide (if needed) labeled for eriophyid mites.

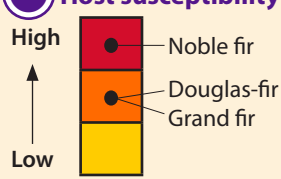
Scouting

- Look for needles at the branch tip that appear white-flecked or fuzzy when mite population is high.
- Check for clear to tan-colored eggs in clusters from late February through March.
- Check for active mites from late April through summer.

Management options

- Begin chemical control measures when new mites emerge (April to May) and again in the fall (October to November).

Host susceptibility



Root Weevil

Otiorhynchus spp. and other species

Signs & symptoms

- Reduced plant growth
- Yellow needles and premature needle loss and/or root damage
- Scalloping or notching along needle margins
- Legless larvae grubs that bend their bodies in the shape of the letter "C"

Where to look

- New fields
- Field edges

Similar symptoms as

- Root problems
- Environmental stress

Root Weevil

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
					SYMPTOMS						
			MONITOR 1		MONITOR 2						
			MANAGE 1		MANAGE 2			MANAGE 3			

Notched needles **1** Look for larvae. **2** Look for adults.

1 Use biocontrol. **2** Spray foliar insecticide (if needed). **3** Prepare the site.

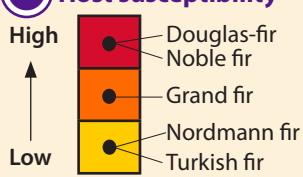
Scouting

- Monitor for adult weevils beginning in late May and early June, especially under needles, on cloudy days and in the evening.
- Scout for larvae on the roots of host plants April to May.

Management options

- At the first appearance of adults, apply chemical control and repeat.
- In the summer and fall, use habitat disruption practices such as disking or tilling, which may reduce populations.

Host susceptibility



Douglas-fir Twig Weevil

Cylindrocopturus furnissi

Signs & symptoms

- Larvae bore through the bark to the wood surface. At maturity, they tunnel deeper, into the pith.
- As needles die, they turn reddish-brown.
- Dead twigs and branches, due to feeding damage
- Deformation of branches and poor growth (seen in Douglas-fir seedlings)

Where to look

- Dry sites with stressed trees
- Douglas-fir weakened by environmental stress or improper planting

Similar symptoms as

- Phomopsis canker
- Bark beetles
- Drought
- Winter damage

Douglas-fir Twig Weevil

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SYMPTOMS											
MONITOR 1				MONITOR 2		MONITOR 3					
						MANAGE 1		MANAGE 2			

Dead branches **1** Look for larvae bore through the bark. **2** Watch for pupa stage. **3** Find adults. **1** Spray insecticide (if needed), targeting emerging adults. **2** Remove dead branches and trees.

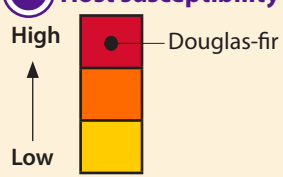
Scouting

- Scout for shoot dieback and feeding galleries on the surface of the wood.
- Look for 1.0 mm diameter adult weevil exit holes.
- Check on dead or dying twigs near the top of the tree.

Management options

- Target control, if needed, against emerging adults from July to August.
- Maintain vigorous growth by using proper cultural procedures.
- Remove and destroy infested trees.
- Avoid planting on dry sites.

Host susceptibility



Interior Needle Loss

All Christmas tree species, especially noble fir

Causes

- Environmental stress, such as low light levels or moisture stress, can accelerate the yellowing and dropping of older needles.

Signs & symptoms

- Loss of interior, older needles
- Older needles turn yellow prior to shedding (late summer and early fall)
- Older needles easily shed from the stems

Where to look

- Interior/older needles

Management options

- Use mechanical shakers to minimize the problems on harvested trees.
- Use high-velocity air (leaf blowers) to remove unsightly needles.

Similar symptoms as

- Interior needle blight syndrome on noble and grand fir
- Other fungal needle casts

Yellow-green Mottle Syndrome

Douglas-fir

Causes

- Unknown

Signs & symptoms

- Yellow-green mottle syndrome on needles of all ages
- Initial symptoms after shoot elongation
- Yellow-green blotches may be small or cover the entire needle; midrib is never affected.
- Affected needles usually fall off the trees, sometimes causing severe defoliation.

Where to look

- Localized areas in the field with trees showing needle loss

Similar symptoms as

- Mite damage
- Nutrient deficiency
- Spray damage

Management options

- Do not spray; sprays are not effective.
- Give affected trees a chance to outgrow the mottling; trees sometimes outgrow the syndrome in 2 or 3 years.
- Remove and destroy trees that are affected every year.

Current Season Needle Necrosis (CSNN)

Causes

- Unknown

Signs & symptoms

- Tan, discolored bands on random needles at the tip of or on the entire needle
- Affected portions turn reddish-brown, and may be shed if the entire needle is affected.
- Symptoms present on newly developed needles, often following high temperature events.
- Secondary organisms can colonize the necrotic tissue.

Where to look

- Valley sites and areas prone to high temperatures during shoot elongation

Similar symptoms as

- Needle rust
- Environmental stress

Current Season Needle Necrosis (CSNN)

Management calendar

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			SYMPTOMS								
					MONITOR						
	MANAGE										

Necrotic needles

Check for symptoms, which commonly develop after high temperatures.

Plant resistant species.

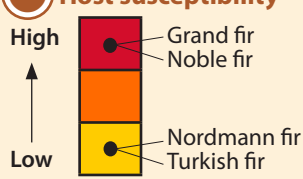
Management options

- Plant resistant species or sources.
- Shade trees during shoot elongation. Shading may reduce symptoms.
- Do not rely on spray treatments, which have shown limited benefit.
- Remove highly susceptible trees.

Scouting

- On noble fir, look for symptoms in upper part of the tree. Damage in other species can vary.
- Check for development of symptoms after high temperature events (over 85°F).
- Examine symptomatic needles during late summer and fall. Symptoms are present on all sides of the trees.

Host susceptibility



Frost Damage

All Christmas tree species, especially early bud-breaking sources

Causes

- Freezing temperatures in the spring when new growth has started to appear

Signs & symptoms

- Browning or wilting of new shoot growth
- Needles with a pale, water-soaked color or brown or red color, depending on degree of damage and species
- Frost-damaged foliage evident within a few days
- Some trees show damage, while others escape injury because of differences in bud break timing.

Where to look

- Trees that break bud early
- Low areas or frost pockets where cold air collects

Similar symptoms as

- Botrytis

Management options

- Do corrective pruning, if damage is severe. Even if damage looks severe when it first occurs, most trees are able to recover.
- Remove damaged growth during shearing.
- On frost-prone sites, cull or avoid some species/sources.

Winter Injury

Any Christmas tree species, especially non-adapted seed sources or exotic species

Causes

- Cold temperatures, desiccation, or formation of ice crystals within cells

Signs & symptoms

- Appears as damage to needles, bark, and bud tissues
- Reddish-brown needles (when only needles are damaged)
- Death of buds or shoots (in severe cases)
- Symptoms may not be evident until warmer conditions later in spring.
- Injured plants cannot obtain water from frozen soil or move water through frozen tissues.

Where to look

- South to southwest side of the tree or on tissue above snow cover

Similar symptoms as

- Drought

Management options

- Carefully monitor sources adapted to extremely cold areas. They may experience winter injury or frost damage as they begin growth too soon in mild winters.
- Learn which locations and/or seed sources/species are more prone than others.

Drought

Causes

- Depleted soil moisture that lasts into the fall
- Late season planting that compromises root growth

Signs & symptoms

- Wilting of new growth, top dieback, tree death
- Loss of interior needles, shortened needles, needle tip dieback, and overall slow growth
- Symptoms generally start at the top of the tree and continue downward.
- Damage may occur over several years

Where to look

- Newly planted trees
- Plants growing on gravelly or sandy soils

Similar symptoms as

- Root problems
- Winter damage

Management options

- To conserve water, eliminate competing vegetation with weed and brush control.
- Assess the type of soil where trees are going to be planted.
- Plant drought-tolerant species.
- Supplement irrigation as a last resort.
- Closely monitor trees weakened by drought because they are prone to other problems, especially insects and diseases.

Heat Damage

Causes

- Extreme high temperatures and/or intense sunlight

Signs & symptoms

- Groups of needles on a shoot quickly turn reddish-brown.
- Entire tree appears burned/reddened due to late-season high temperatures that damage needles and shoots.
- Heat, drought, and sunscald damage are closely related.

Where to look

- South or southwest side of the trees

Similar symptoms as

- Current season needle necrosis
- Mechanical damage
- Chemical injury

Management options

- Protect young seedlings using shade devices, such as shingles and cards.
- In older plantings, try to maximize soil moisture levels.

2,4-D and triclopyr

True firs are more susceptible to these chemicals.

Causes

- 2,4-D and triclopyr are hormone-type herbicides used to control annual and perennial broadleaf weeds. These products are translocated throughout the plant.

Signs & symptoms

- Distorted plant parts, including twisting and curling on new growth
- Swollen shoot tips
- Severity of damage depends on amount applied, timing, and other herbicides in the mixture.
- Damage also possible from drift of the herbicide

Where to look

- New growth is the most susceptible.

Similar symptoms as

- Shoot dieback

Management options

- Direct spray away from foliage. Use shields and low-drift nozzles.
- If using a chemical, follow label directions for the rate, timing, and tree species.
- Calibrate application equipment properly.
- Avoid spraying on hot days. Amine forms are safer near trees.

Fertilizer Burn

Causes

- Nutrient excesses, resulting from inappropriate or excessive fertilizer use, can damage or kill trees.

Signs & symptoms

- Reddish-brown discoloration or necrosis on the tips of newly developing needles
- All needles with similar levels of damage (unlike a fungal disease, in which only a few random needles are affected)

Similar symptoms as

- Chemical injury

Where to look

- Damage pattern follows application area. Pay attention to newly planted seedlings and small trees.

Management options

- Match fertilizer applications with tree growth and need.
- Time fertilizer application for the appropriate season (typically February to March).
- Calibrate applications.

Glyphosate (Roundup)

Causes

- Glyphosate is a nonselective herbicide that interferes with amino acid synthesis. It is translocated throughout the plant.

Signs & symptoms

- Applied prior to bud break: stunted new growth; short and pale green foliage
- Applied after bud break: rapid death of new needles; foliage with burned or desiccated appearance

Where to look

- Plants partially hit by sprays
- New growth

Similar symptoms as

- Botrytis

Management options

- Know spray timing and product options and usage. This information is critical.
- Carefully read all label instructions and precautions prior to purchasing and applying these herbicides.
- Avoid surfactants or combinations, which can increase tree damage.

Triazines

(atrazine, simazine, Velpar and others)

Douglas-fir and newly planted seedlings are more sensitive to damage.

Causes

- Triazines are herbicides used to control grasses and some broadleaf weeds. These products are photosynthetic inhibitors.

Signs & symptoms

- Yellowing on needle tip and margin
- More pronounced damage with higher temperatures
- Light-textured soils prone to more damage

Where to look

- Newly planted container seedlings or sites with light-textured soils.

Similar symptoms as

- Current season needle necrosis

Management options

- Know spray timing and product options and usage. This information is critical.
- Carefully read all label instructions and precautions prior to purchasing and applying these herbicides.
- Apply lower product rates on light-textured soil.

Deer, Elk, Mice, & Voles

Damage from deer and elk is common on Douglas-fir in the spring, and on Fraser, Turkish, and Nordmann fir in winter and spring.

Causes

Deer and elk	Mice and voles

Signs & symptoms

Antler rubbing

- Occurs on trees with open internodal spaces. Often bark is scraped off, producing long-lasting injury.

Foliage feeding

- Damage to leaders and upper branches, usually the current season foliage

- Small feeding marks around the stem of seedlings
- A decrease in tree growth from sublethal feeding injuries
- Tree death, if smaller trees completely girdled

Where to look

- Droppings and tracks around the base of trees aid in identification.
- Stems of seedlings, just above ground level, especially during winter and early spring

Management options

- Fencing, repellents for individual tree protection

- Maintain weed control in the rows, particularly around the base of the tree; bare ground exposes rodents to predators.

Rabbits & Birds

Causes

Rabbits

Signs & symptoms

- Damage on young trees
- Shoots cut off at a 45-degree angle or girdling at the base
- Significant amounts of bark removed, or tree is completely cut.

Where to look

- Stems of young trees up to 2 ft from the ground

Management options

- Maintain weed control in the rows, particularly around the base of the tree. Use hazing, shooting, fencing, and tree tubing.

Birds

Signs & symptoms

- Broken treetops (from May to July) when new tops are just elongating

Where to look

- Tall trees are most vulnerable.

Management options

- Place poles or perches throughout the fields at a height above the trees. Use frightening devices.

Mechanical Damage

Causes

- Equipment and tools

Signs & symptoms

- Broken lower branches and areas of dead foliage where tires and equipment have run over or forced branches apart
- Bark/trunk damage (trees on row ends) that looks like cankers with dead branches above the damaged area
- Damaged foliage at a consistent height and side on rows where equipment has passed and exhaust fumes or heat have caused injury
- Split branch ends from dull shearing knives or cutting tools that do not cut cleanly. Branch ends to shatter and die.

Where to look

- Trees at row ends
- Lower branches; branches at equipment level

Similar symptoms as

- Vertebrate damage
- Drought

Management options

- Lay out field to leave enough space on row ends and between rows to allow for tractor turns and passage next to full-grown trees.
- Shield tractor tires and equipment to allow for passage between the rows.
- Minimize trips through the rows during bud break, as new growth is easily broken.
- Prevent prolonged contact of foliage with exhaust.
- Maintain sharp shearing and cutting tools to ensure well-cut branch ends.
- Use basal pruning, which can minimize lower branch damage.

GLOSSARY

blight Sudden, severe, and extensive spotting, discoloration, wilting, or destruction of leaves, flowers, stems, or entire plants.

canker Symptom of infection on woody plant stems or tree trunks. It can appear dry, dying, or dead; be on a localized area of the stem; and sometimes produces a reddish ooze through the bark.

chlorosis Process of yellowing of leaves due to lack of chlorophyll. Often as a result of disease or nutrient deficiency.

dieback Progressive death of shoots, leaves, or roots, beginning at the tips.

fungicide Chemical substance that kills or inhibits the growth of fungi or oomycetes.

herbicide Chemical substance used to destroy or inhibit the growth of plants, especially weeds.

host plant Plant on which an organism (e.g., insect or microbe) lodges and subsists.

insecticide Chemical substance used to destroy insect pests.

miticide Chemical substance that kills or inhibits the growth of mites.

necrosis Death of cells or tissues through injury or disease, especially in a localized area of the body. Necrosis can discolor stems or leaves, or kill a plant entirely.

plant pathogen Disease-producing organism or agent in a plant (e.g., virus, bacteria, fungi).

resistant plant Plant with properties that prevent or reduce disease development or the attack of pests.

rot Softening, discoloration, and often disintegration of plant tissue as a result of infection.

scouting Method for monitoring plant health based on regular visual inspection of the crop.

sign Indication of disease from direct observation of a pathogen or its parts.

spore General term that refers to any single-celled reproductive structure of fungi, oomycetes, and some other organisms.

susceptible plant Plant prone to attack by insects or pathogens.

symptoms Any physical change in the plant that is a result of attack from an insect or pathogen.

PHOTO CREDITS

Photos are listed by page number/position–(T)op, (M)iddle, (B)ottom

Cover..... Lynn Ketchum, Oregon State University (OSU)
1/T, M ..... Chal Landgren, OSU
1/B .....Gary Chastagner, Washingon State University (WSU)
2 ..... C. Landgren
3/all..... C. Landgren
4 ..... C. Landgren
5/T..... G. Chastagner
5/M, B ..... C. Landgren
6 ..... G. Chastagner
7/T, M ..... G. Chastagner
7/B ..... C. Landgren
8..... C. Landgren
9/T ..... Ralph Byther, WSU
9/M..... Kathy Riley,WSU
9/B ..... C. Landgren
10 ..... R. Byther
11/T.....USDA Forest Service - North Central Research Station Archive, USDA Forest Service, Bugwood.org
11/M..... G. Chastagner
11/B ..... C. Landgren
12 ..... R. Byther
13/T..... C. Landgren
13/M,B ..... G. Chastagner
14 ..... G. Chastagner
15/all ..... G. Chastagner
16 ..... R. Byther
17/T.....Jay W. Pscheidt, OSU
17/B ..... R. Byther
18 ..... R. Byther
19/T, M .....Rayanne D. Lehman, Pennsylvania Dept. Agriculture (PDA)
19/B ..... C. Landgren
21/all ..... C. Landgren
22 ..... C. Landgren
23/T.....Luisa Santamaria, OSU
23/M, B..... C. Landgren
25/M (upper)..... Arthur Antonelli, WSU
25/T, M (lower) ..... Robert L. Anderson, USDA Forest Service, Bugwood.org
25/B ..... C. Landgren
27/T, M ..... Sandy Gardosik, PDA
27/B ..... Bryan Schildt, PDA
29/T. ....USDA Forest Service Archive, USDA Forest Service, Bugwood.org
29/M, B (right) ..... Tracey Olsen, PDA
29/B (left) ..... C. Landgren
31/T. ....USDA Forest Service - Northeastern Area Archive, USDA Forest Service, Bugwood.org
31/M .....S. Gardosik, PDA
31/B ..... C. Landgren
33/T,B..... S. Gardosik, PDA
33/M.....Robin Rosetta, OSU
34 ..... C. Landgren
35/T.....Oregon Department of Agriculture
35/M, B..... C. Landgren
36 ..... Ken Gray Insect Image Collection, OSU
37/T..... Ken Gray Insect Image Collection, OSU
37/M, B..... C. Landgren
38 ..... C. Landgren
39/all ..... C. Landgren
40/all ..... G. Chastagner
41/T..... R. Byther
41/M, B..... C. Landgren
42 ..... R. Byther
43/all ..... C. Landgren
44/all ..... C. Landgren
45/all ..... C. Landgren
46/all ..... C. Landgren
47/all ..... G. Chastagner
48/all ..... C. Landgren
49/all ..... C. Landgren
50/all ..... Ricky Bates, Penn State University
51/T, B..... C. Landgren
51/M..... Michael Bondi, OSU
52/T, B (left)..... C. Landgren
52/B (right) .....Rick Fletcher, OSU
53 ..... C. Landgren

Use pesticides safely!

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
- Read the pesticide label—even if you've used the pesticide before. Follow closely the instructions on the label (and any other directions you have).
- Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

Trade-name products and services are mentioned as illustrations only. This does not mean that the participating Extension Services endorse these products and services or that they intend to discriminate against products and services not mentioned.

Pacific Northwest Extension publications are produced cooperatively by the three Pacific Northwest land-grant universities: Oregon State University, Washington State University, and the University of Idaho. Similar crops, climate, and topography create a natural geographic unit that crosses state lines. Since 1949, the PNW program has published more than 600 titles, preventing duplication of effort, broadening the availability of faculty specialists, and substantially reducing costs for the participating states.

Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Oregon State University Extension Service, Washington State University Extension, University of Idaho Extension, and the U.S. Department of Agriculture cooperating.

Published April 2014.