



DROUGHT & CONIFER MORTALITY IN THE WILLAMETTE VALLEY

Forest Health & Monitoring Unit
Oregon Department of Forestry

HISTORY & HYPOTHESIS

Beginning in approximately 2001, there has been an unusual pattern of tree mortality in the Willamette Valley involving Douglas-fir, grand fir, and western red cedar. Although many of these dead and dying conifers show signs of insect damage or disease infections, it seems that water stress brought on by drought and other factors is the central cause in these mortality events. Weather records support the hypothesis that dry conditions are the preeminent factor in these occurrences, and this is further strengthened by the relative drought tolerances indicated in the table below.

*Relative Drought Tolerance for Tree Species in the Willamette Valley**
(Tolerance Rating: 1 = High; 5 = Low)

<u><i>Tree Species</i></u>	<u><i>Drought Tolerance</i></u>
<i>Oregon white oak</i>	1
<i>Ponderosa pine</i>	1
<i>Incense-cedar</i>	2
<i>Douglas-fir</i>	3
<i>Grand fir</i>	4
<i>Western red cedar</i>	4

**Developed by William Emmingham, Extension silviculturist emeritus, Oregon State University*

DOUGLAS-FIR

The current episode of Douglas-fir mortality in the Valley began in 2001 and continues to the present. Often, the sites where dying Douglas-fir is encountered lends credence to the importance of water stress. Frequently, dying trees are <30 years in age and growing on shallow, rocky, or droughty (heavy clay) soils. These sites may not have supported conifer forests in the past and are unsuitable for Douglas-fir over the long term. Mortality is also common along roads, the edges of stands, and in open-grown trees. Douglas-fir at these exposed locations is subject to higher temperatures and increased levels of water loss, often leading to damage from insects or disease. Some the agents that commonly infest Douglas-fir on these sites include the Douglas-fir twig weevil, Douglas-fir engraver beetle, along with branch or stem cankers.

(See also "Dead Branches, Dead Tops & Dead Trees: The Interaction of Water Stress, Insects & Disease" located on the forest health website below).

GRAND FIR

Grand fir mortality in the Valley is largely associated with outbreaks of the fir engraver bark beetle, whose population increases dramatically following 1-2 years of below-normal precipitation. Increased grand fir mortality was first detected in 2002 and remained at high levels until 2004. Despite the relative declines in recent years, scattered tree mortality continues to occur. Dying trees are usually mature and

located in overstocked stands where they compete with Douglas-fir, a somewhat more drought tolerant species. Mortality also occurs consistently on open-grown trees and at drier sites located along the edges of the Valley. Although it was historically common in wet, low elevation sites throughout the Valley, grand fir appears to be largely disappearing due to the combined effects of fir engraver outbreaks as well as a recently introduced invasive, sucking insect, the balsam woolly adelgid.

WESTERN RED CEDAR

Reports of unusual western red cedar mortality at low elevation sites in the Valley, particularly in Clackamas County, began in 2003 and continue to the present. Dying trees are typically second-growth and are located in drought prone sites or in overstocked stands containing Douglas-fir, grand fir, or hardwoods. The current episode of Western red cedar mortality has been observed as far north as the east-side of Vancouver Island, indicating that this is likely part of a regional trend. While round-headed borers and cedar bark beetles often colonize dying trees, the majority of red cedars contain relatively few insects, and it appears most are succumbing solely to the effects of drought. While root disease can also play a role in cedar mortality, field checks have shown that most root systems remain alive while the aerial portion of the tree dies; providing additional support for the role of water stress.

TREATMENT STRATEGIES: WHAT YOU CAN DO

In the Willamette Valley, tree mortality related to water stress is often concentrated on lower elevation sites and frequently involves multiple tree species dying in the same general area. The trees most susceptible to drought effects are typically found on poor sites or in overstocked stands. Three of the most drought-susceptible species, Douglas-fir, grand fir, and western red cedar will often grow well in marginal sites for decades. However, as they increase in size, they will also have an increasingly difficult time surviving dry periods when in competition with better-adapted species.

For those practicing forestry in the Valley, the best approach for minimizing drought-related mortality is to plant trees that are well suited to the site through the selection of local seed sources and species adapted to the soil type. Thinning currently overstocked stands will also increase tree vigor and provide greater resistance to insects and diseases. On sites where Douglas-fir mortality is occurring, it may be advisable to use more drought-tolerant Valley Ponderosa pine. In landscape settings, irrigate potentially susceptible trees during dry weather periods. Apply water slowly over many hours so it penetrates to roots. Reducing competing vegetation and using mulch can also increase soil moisture. Avoid fertilizing during drought conditions as this stimulates foliage production and can increase a tree's water requirements.

There are a number of other insect and disease agents that cause mortality in both water-stressed and healthy trees in the Valley each year. Therefore, it is often helpful to consult your local Department of Forestry, Extension office, or private forestry consultant to assist in identifying the problem and developing a strategy.

For Additional Information About Insects & Disease, Contact:

Rob Flowers, ODF Entomologist, 503-945-7396, rflowers@odf.state.or.us

Alan Kanaskie, ODF Pathologist, 503-945-7397, akanaskie@odf.state.or.us

Forest Health Notes @ http://egov.oregon.gov/ODF/PRIVATE_FORESTS/fh.shtml