

# IMPACTS OF SWISS NEEDLE CAST ON

## DOUGLAS-FIR IN THE CASCADE FOOTHILLS OF NORTHERN OREGON: FIVE-YEAR RESULTS

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### INTRODUCTION

Swiss needle cast (SNC), caused by the fungus, *Phaeocryptopus gaeumannii*, is one of the most damaging diseases affecting Douglas-fir in the Pacific Northwest USA (Hansen et al. 2000). Annual Douglas-fir volume-growth losses from SNC are estimated at about 23% over 187,000 acres with some losses as high as 52% in the Oregon Coast Range (Maguire et al. 2002). Although impact from SNC occurs in the northern Cascade Mountains of Oregon, it is assumed to be less than damage in the Coast Range. Objectives of our project were to determine changes after 5-years (2001 to 2006) in 1) tree diameter and total-height growth and 2) Swiss needle cast severity as estimated by needle retention, stomata occlusion by pseudothecia, and crown-length/sapwood-area ratio (Maguire and Kanaskie 2002) in 59 stands in the northern Oregon Cascade Mountains.



Occluded needle stomata



Typical sampled stand

### METHODS

From April to June, 2001 and 2006, prior to Douglas-fir budbreak, transects were installed and examined in 59 stands. Sampled stands were 10- to 23-years old and contained more than 50% Douglas-fir. Stands were systematically located on lands administered by USDA Forest Service, USDI Bureau of Land Management, Weyerhaeuser Corp, Port Blakely Tree Farms, or Longview Fibre Co. Each stand has one transect with five sample points located at 50-foot intervals. Stand data collected in 2001 included: 1) elevation, 2) slope aspect, 3) slope %, and 4) GPS coordinates. At each sample point, the nearest dominant or dominant Douglas-fir on each side of the transect was selected for a total of 10 trees per stand. Data collected for each tree included: 1) stand, point, and tree no., 2) dbh, 3) total height, 4) height to lowest live branch, 5) ocular estimation of foliage retention in the mid-crown (0 to 6 yrs), 6) foliage-retention index of a sampled branch, and 7) % stomata occluded by pseudothecia (in 2002). In 2006, crown-length to sapwood-area ratio was estimated for 5 trees per stand. Because some stands were thinned and stand density can influence tree growth, total basal area/acre and basal area/acre of Douglas-fir were calculated at each of the five sample points. All data were entered into an Excel spreadsheet where  $R^2$  values were calculated from selected graphed data.

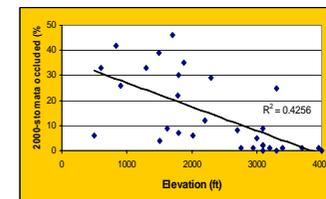
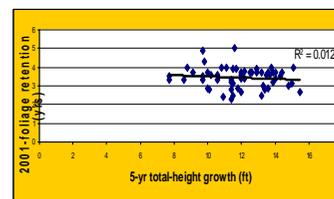
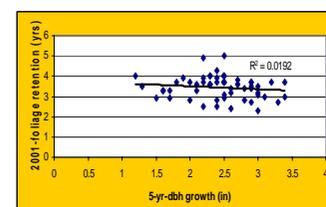
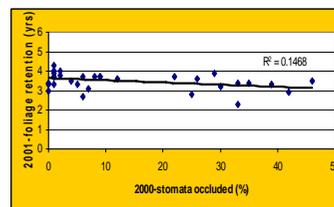
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### RESULTS

In 2001 and 2006, we examined 590 Douglas-firs in 59 stands in the northern Oregon Cascade foothills. Stands ranged in elevation from 500 to 4,200 ft., slope from 0 to 60%, and total basal area/acre from 20 to 158 ft<sup>2</sup>. Mean 5-year-dbh growth was 2.4 in. (range = 1.2 to 3.4) and total-height growth was 11.9 ft. (range = 7.7 to 15.5). Mean needle-retention index increased by 3.4 (range = -3.4 to 11.8) over 5 years, and mid-crown retention increased by 1.2 years (range 0.2 to 2.3). Mean percentages of stomata occluded by pseudothecia were 13.6% for 2000-(2-year-old) needles and 1.7% for 2001-(1-year-old) needles sampled in 2002, and 13.3% for 2004 (2-yr-old) needles sampled in 2006. Mean crown-length to sapwood-area ratio was 5.2 cm/cm<sup>2</sup> and ranged from 2.3 to 9.0 in 2006.

There were poor correlations ( $R^2 < 0.3$ ) among all variables except for stand elevation where there was a moderate correlation between stand elevation and either 2000-stomata occluded ( $R^2 = 0.43$ ) or 2004-stomata occluded ( $R^2 = 0.50$ ). There were fewer pseudothecia at the higher elevations. Either five years is not enough time to evaluate the affects of Swiss needle cast on Douglas-fir growth in the Oregon Cascades or there was no significant effect of Swiss needle cast during the latest outbreak on Douglas-fir growth.



### CONCLUSIONS

There are at least two possible reasons why there may be no appreciable affect of Swiss needle cast on Douglas-fir 5-year-diameter and height growth during the latest SNC outbreak in the Cascade Range:

- 1) Oregon Cascade Range site characteristics, including plant associations, soil chemistry and parent material, air temperatures, and monthly precipitation and leaf wetness, may not be as conducive to elevated populations of the causal fungus, *Phaeocryptopus gaeumannii*, and subsequent severe defoliation, as in the Oregon Coast Range.
- 2) The genetics (lineage 1) of isolates of the causal fungus in the Oregon Cascades more closely resemble isolates from Idaho, Europe, and New Zealand than isolates from the Oregon Coast Range (Winton and Stone 2004). Also, lineage 2, which is abundant in the Oregon Coast Range, has not been reported in the Cascade Mountains.

Based on our results and their interpretation, forest managers may need not alter their current practices in the northern Oregon Cascades, and managing a mix of Douglas-fir and western hemlock at lower elevations and noble fir at higher elevations will help offset any future stand-growth declines due to Swiss needle cast or other pest outbreaks (Filip et al. 2000). Plans are to resample Cascade stands in 5 years (2011).

### ACKNOWLEDGEMENTS

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