



IMPACTS OF SWISS NEEDLE CAST IN THE CASCADE MOUNTAINS OF NORTHERN OREGON: MONITORING OF PERMANENT PLOTS AFTER TEN YEARS

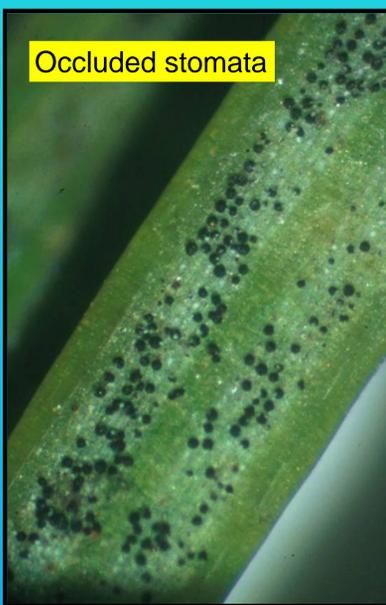


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INTRODUCTION

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, Shaw et al. 2011). 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 10 years (2001 to 2011) in 1) tree diameter and total-height growth and 2) Swiss needle cast severity as estimated by needle retention and stomata occlusion by pseudothecia in 59 stands in the northern Oregon Cascade Mountains.



Occluded stomata



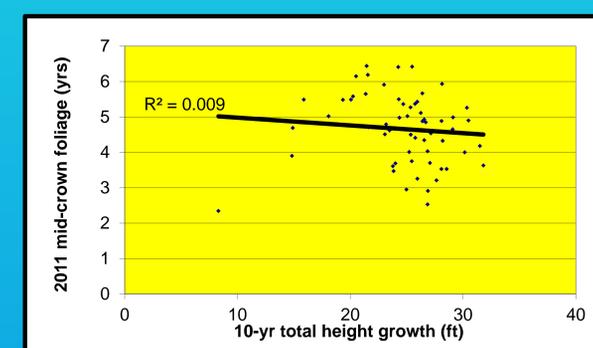
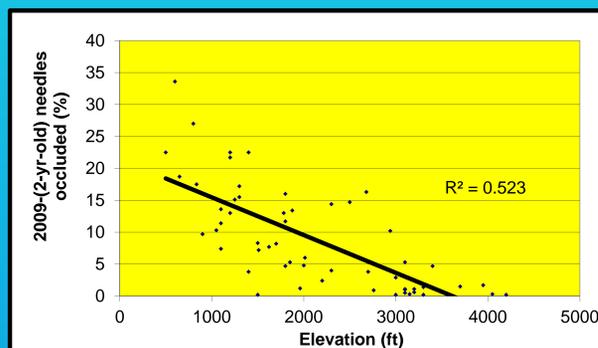
Typical sampled stand

CONCLUSIONS

There are at least three possible reasons why there may be no appreciable effect of Swiss needle cast on Douglas-fir 10-year-diameter and height growth during the latest SNC outbreak in the Cascade Range:

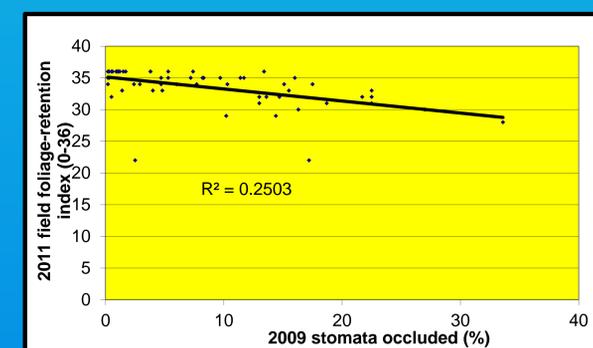
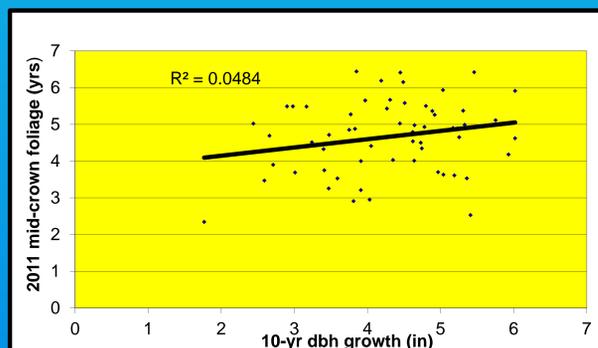
- 1) The SNC outbreak over the past 10 years in the Cascade Range is not as severe as in the Oregon Coast Range. Only a few stands sampled in the Cascades had mean foliage retention of <3 years. There were no stands with mean stomata occlusions >50% on 2-year-old needles in 2001, 2006, and 2011.
- 2) 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.
- 3) 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 do not need to change their current practices in the northern Oregon Cascades. 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 should such develop (Filip et al. 2000).



METHODS

From April to July, 2001, 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, Oregon Department of Forestry, Weyerhaeuser Corp, Port Blakely Tree Farms, or Longview Fibre Co. Each stand had 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 co-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 in 2001, 2006, and 2011 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 (scale 0-36), and 7) % stomata occluded by pseudothecia (in the lab). 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 R² values were calculated from selected graphed data.



RESULTS

In 2001, 2006, and 2011, we examined 590 Douglas-firs in 59 stands in the northern Oregon Cascade Mountains. Stands ranged in elevation from 500 to 4,200 ft., slope from 0 to 60%, and current total basal area/acre from 34 to 198 ft². Mean 10-year-dbh growth was 4.2 in. (range = 1.8 to 6.0) and total-height growth was 24.7 ft. (range = 8.3 to 31.8). Mean field foliage-retention index decreased by 0.4 (range = -15.8 to 8.6) over 10 years. When lab measurements were used, however, foliage-retention index increased by 3.2. Mid-crown foliage increased by 1.2 years (range -0.7 to 3.0). Mean percentage of stomata occluded by pseudothecia was 8.7% for 2009-(2-year-old) needles sampled in 2011. There were poor correlations (R² <0.3) among most variables except for stand elevation where there was a moderate correlation between stand elevation and either 2011 foliage-retention index (R²=0.52) or 2009- occluded stomata (R² = 0.52). There were fewer pseudothecia and better foliage retention at the higher elevations. **There was no apparent effect of Swiss needle cast during the latest outbreak on Douglas-fir growth.**

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