

EFFECT OF SWISS NEEDLE CAST ON DOUGLAS-FIR CROWN STRUCTURE AS IT RELATES TO FIRE RISK AND POTENTIAL FIRE BEHAVIOR IN YOUNG PLANTATIONS OF WESTERN OREGON

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INTRODUCTION

Catastrophic wildfires were an important component of the Oregon Coast Range historically. In fact, some of the largest fires in the state have occurred in this region. Swiss needle cast (SNC), an increasingly important foliar disease of Douglas-fir, may be changing catastrophic wildfire risk in this region. SNC may intensify fire risk by enhancing vertical continuity in ladder fuels, increasing rates of fine fuel accumulation, and altering combustion rates through changes in crown bulk density and moisture content. Currently, over 157,000 ha of Douglas-fir forestland in western Oregon have symptoms of SNC. This study was initiated to examine the relationship between SNC, Douglas-fir crown structure and fire risk in the region.



Figure 1. Impacts of SNC on Douglas-fir in Oregon Coast Range. Symptoms include premature foliage loss, needle yellowing, and reduced height and radial growth.

OBJECTIVES

The overall objective of this study was to assess the degree to which young (10-30 yrs-old), Douglas-fir plantations impacted by SNC experience an increased susceptibility to wildfire.

Specific objectives of the project include:

- describing quantitatively the changes in crown structure and tree morphology resulting from SNC;
- assessing the effects of SNC on stand structure and litter dynamics;
- linking these tree and stand changes to resulting alterations of fuel loads and potential fire behavior in trees with varying degrees of SNC damage;
- establishing the best procedure for rating SNC damage and stand fire risk

METHODS

Using data from permanent monitoring plots, 82 destructively sampled trees, and 150 litterfall traps, linear regression models were constructed to test hypotheses regarding the influence of SNC on Douglas-fir crown structure as it relates to fire risk. Vertical distribution of crown dry matter was characterized by fitting a β -distribution to each tree. Stand-level estimates of canopy bulk density and canopy fuel load were constructed as the composite of individual sample trees and litterfall.

RESULTS

The data indicated that both Douglas-fir crown structure and morphology have been significantly altered by the disease, which influenced several stand-level attributes. Due to these changes, fire risk and potential fire behavior, particularly surface fire, have been modified in this region. This is supported by the following findings:

- both crown bulk density and canopy fuel loads were significantly reduced by the disease (Figure 2) due to the premature loss of foliage and reductions in the size and number of primary branches
- vertical distribution of canopy fuel was shifted downwards with greater SNC (Figure 3)
- canopy base heights were significantly lower with greater SNC
- with increasing SNC, foliage litterfall rates were lower than normal and fine woody material litterfall rates were greater due to the increased rates of crown recession
- regardless of SNC level, a larger proportion of foliage litterfall occurred in the summer months and litterfall rates were much higher when compared to other similar studies (Figure 4)
- live wood moisture content was significantly reduced by the disease
- work is currently being done on foliar moisture content and in older stands

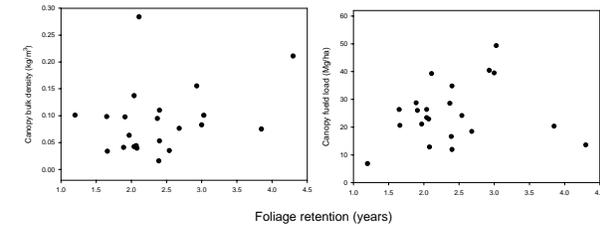


Figure 2. Relationship of foliage retention with canopy bulk density (left) and canopy fuel load (right)

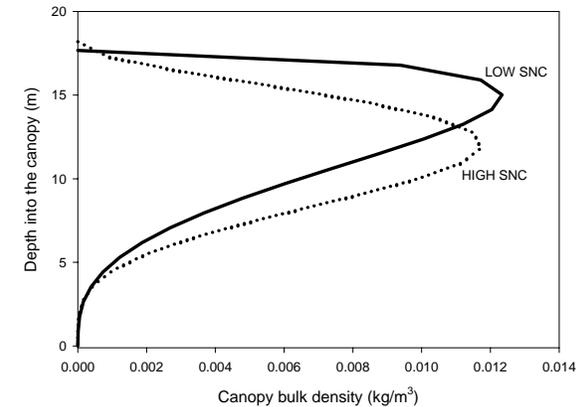


Figure 3. Vertical distribution of canopy bulk density for plantations with low SNC (solid line) and high SNC (dashed line).

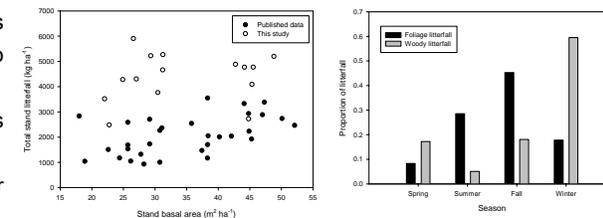


Figure 4. Total litterfall (kg ha^{-1}) over stand basal (left) and seasonal distribution of litterfall for an average stand in this study (right).