

# Effects of Western Spruce Budworm Defoliation on the Northern Spotted Owl and Its Habitat in Southcentral Washington: *Interim Project Report 2*

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## Cooperators

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## Introduction

Mixed conifer forests growing east of the Cascade Mountains crest in Oregon and Washington have experienced repeated defoliation by the western spruce budworm (*Choristoneura occidentalis*) since the early 1980's. Significant defoliation has occurred in critical habitat of the northern spotted owl (*Strix occidentalis caurina*), a federally listed Threatened and Endangered species.

We currently lack quantitative information on the effects of western spruce budworm defoliation upon northern spotted owls and their habitat. Prior studies have quantified the effects of budworm defoliation on tree growth and mortality, and a couple of studies have looked at sub-watershed-scale changes in vegetative structure and composition in relation to fire hazard, but few studies have examined the relationships among defoliation, owl demography, and owl habitat at the broader landscape scale.

This study will attempt to characterize landscape-level associations and trends among western spruce budworm defoliation, vegetation conditions, northern spotted owl populations and other associated disturbance, during the period 1985-2003.

## Methods

### Project Boundaries

The study area was defined using GIS overlays of:

- northern spotted owl habitat.
- aerial survey maps of western spruce budworm defoliation.
- topographical features of southcentral Washington.

### Changes in Vegetation

- Change detection analysis will be conducted using pre-defoliation (1985) and ongoing/post-defoliation (2003) satellite imagery (Landsat 5 TM).
- 200 ground sample points (0.25 acre fixed area plots) will be used to verify 2003 satellite image classifications (100 "defoliated," 100 "undefoliated"). Sample points were generated using the Sample Points Generator (SPGen) program developed by V. Thomas and M. Downing of FHTET and R. Reich of Colorado State University. Plot measurements include number of trees, tree species, diameter (dbh), mortality, defoliation severity, and canopy cover class.
- GIS layers of disturbance (fire, logging) will be compiled and analyzed.
- Forest inventory (CVS and FIA) data will be associated with defoliation classifications.
- Defoliation impact data from 3 owl core habitat areas, collected during early, mid- and post-budworm outbreak will be assessed for stand-level changes.

### Owl Populations

- Assess owl demographic information (occurrence, abundance, fecundity, survival, movement) from the study area, collected since 1985.

### Trends and Associations

Evaluate associations between number of years and severity of budworm defoliation and:

- vegetation conditions.
- owl demography.
- other associated disturbance.

## 2006 Results

### Ground Sample Points

- Ground sampling was completed on an additional 131 fixed area plots (0.25 acre) in 2006, bringing the total number of sample plots to 219.
- Ground sample points agreed with the preliminary satellite imagery-based model prediction for defoliation about 80 (79.64) percent of the time.
- Vegetative data from forested sample plots (n=197) were stratified into four categories (plot classes) according to species composition and defoliation history for analysis (host type was defined as host species (true firs, Douglas-fir, and spruce) composition exceeding 30 percent TPA):
  1. Western spruce budworm host type with discernable evidence of past or present defoliation ("Host-Defoliation"; n=82)
  2. Western spruce budworm host type with no discernable evidence of defoliation ("Host-No Defoliation"; n=69)
  3. Nonhost type with defoliation ("Nonhost-Defoliation"; due to small sample size (n=5), these plots were excluded from the summary analyses shown below)
  4. Nonhost type without defoliation ("Nonhost-No Defoliation"; n=41)
- Higher stocking levels occurred on "Host-Defoliation" plots than on either the "Host-No Defoliation" or "Nonhost-No Defoliation" plots (Fig. 1). Average mortality recorded on "Host-Defoliation" plots exceeded mortality on "Host-No Defoliation" plots by a factor of two, and was nearly three times that recorded on "Nonhost-No Defoliation" plots (Fig. 2). "Host-Defoliation" plots had less canopy cover than "Host-No Defoliation" plots; the distribution of average canopy cover index values for "Host-Defoliation" plots most closely resembled that of "Nonhost-No Defoliation" plots (Fig. 3).

Plot Class (forested)	% Host (TPA)	TPA	Ave DBH	BA Ft/Ac	BA Me/Ha
Host-Defoliation	78.92	194.00	12.41	199.14	5.32
Host-No Defoliation	73.70	175.42	11.96	149.56	7.09
NonHost-No Defoliation	12.81	132.78	10.62	81.76	2.91

Figure 1. Ground plot tree data summary by plot class, all trees.

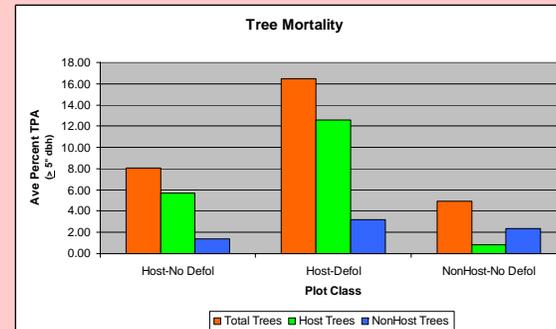


Figure 2. Ground plot mortality by plot class. Host trees = True firs, Douglas-fir, and spruce.

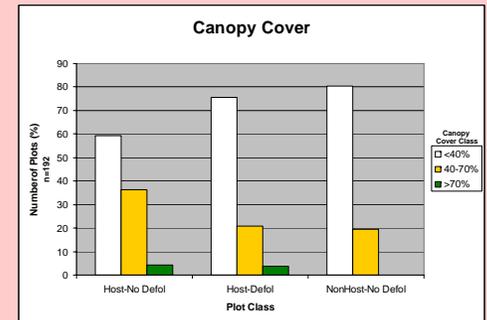


Figure 3. Canopy cover class distribution among plot classes.

## Discussion

"Eastside" forests that fall within the 1994 Northwest Forest Plan-defined habitat boundaries for the northern spotted owl typically are dense, multilayered, mixed conifer forests having a large component of budworm host (Douglas-fir and true firs). These forests developed from a previously more open and early seral condition during the past century as a result of fire suppression and selective logging of seral species. The same features that make these eastside mixed conifer forests suitable owl habitat (dense, multiple canopy layers, high levels of dead wood) also make them highly susceptible to habitat degradation and loss resulting from frequent mid- to large-scale disturbances caused by budworm defoliation, bark beetles, and fire.

Issues surrounding the management of eastside forests occurring within the habitat of the northern spotted owl are complex and often controversial. Better understanding of the functional effects of defoliation on owls and owl habitat would assist policy-makers and managers with decisions regarding eastside forest management and response to defoliator outbreaks.

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