95 Extension Note

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User-friendly Web Tool to Support Silviculture for Sitka Spruce on the South Coast

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Introduction

Pissodes strobi, the terminal weevil that preferentially attacks leaders of Sitka spruce between 2 and 15 m tall, has become a major deterrent to selecting this species for reforestation. Successful weevil attacks kill the leader and a lateral shoot takes over, forming a crook in the stem. Repeated and severe attacks prevent seedlings from reaching free-growing status, and render trees unmerchantable due to bole defects. However, trees may recover from less severe attacks and attain good form upon maturity. Weevil hazard is therefore better indicated by the severity of the effects on form than by the number of attacks.

Decades of research and tree improvement have culminated in available terminal weevil resistant Sitka spruce seed for reforestation. Foresters can expect fewer than half the attack levels of local wild stands from bulk seedlots from the superior provenances Haney and Big Qualicum, and over 80% reduction from class A orchard seed (King and Alfaro 2009). The objective of this study was to develop a user-friendly, accurate web tool that foresters could use to support reforestation prescriptions for sites on Vancouver Island where Sitka spruce is an appropriate species.

Tool Development

Data on weevil attack levels and severity, environmental variables (vegetation, soils, topography), and stand composition (species, density, and height of canopy and regeneration) were collected from 55 natural and artificially regenerated stands around Vancouver Island containing at least 15% or 100 stems per hectare of Sitka spruce. Since weevil development is influenced by temperature (degree days above 7.2°C: McMullen 1976), a climate model was used to calculate baseline weevil hazard for a given location using ClimateBC (Wang et al. 2006) and Environment Canada meteorological station data. Mean annual attack rates are based on King and Alfaro (2009) (Figure 1).

McMullen's (1976) threshold of 888 degree days separating low and high attack severity sites did not correspond well with observed attack rates, which were within the range observed by King and Alfaro (2009) for wild stands at a given site. After adjusting for the effects of the fog belt, increasing degree days explained only 11% of the variation in attack severity (8.6% without adjusting for the fog belt). Regression analyses were used to determine which other factors significantly affected weevil hazard.

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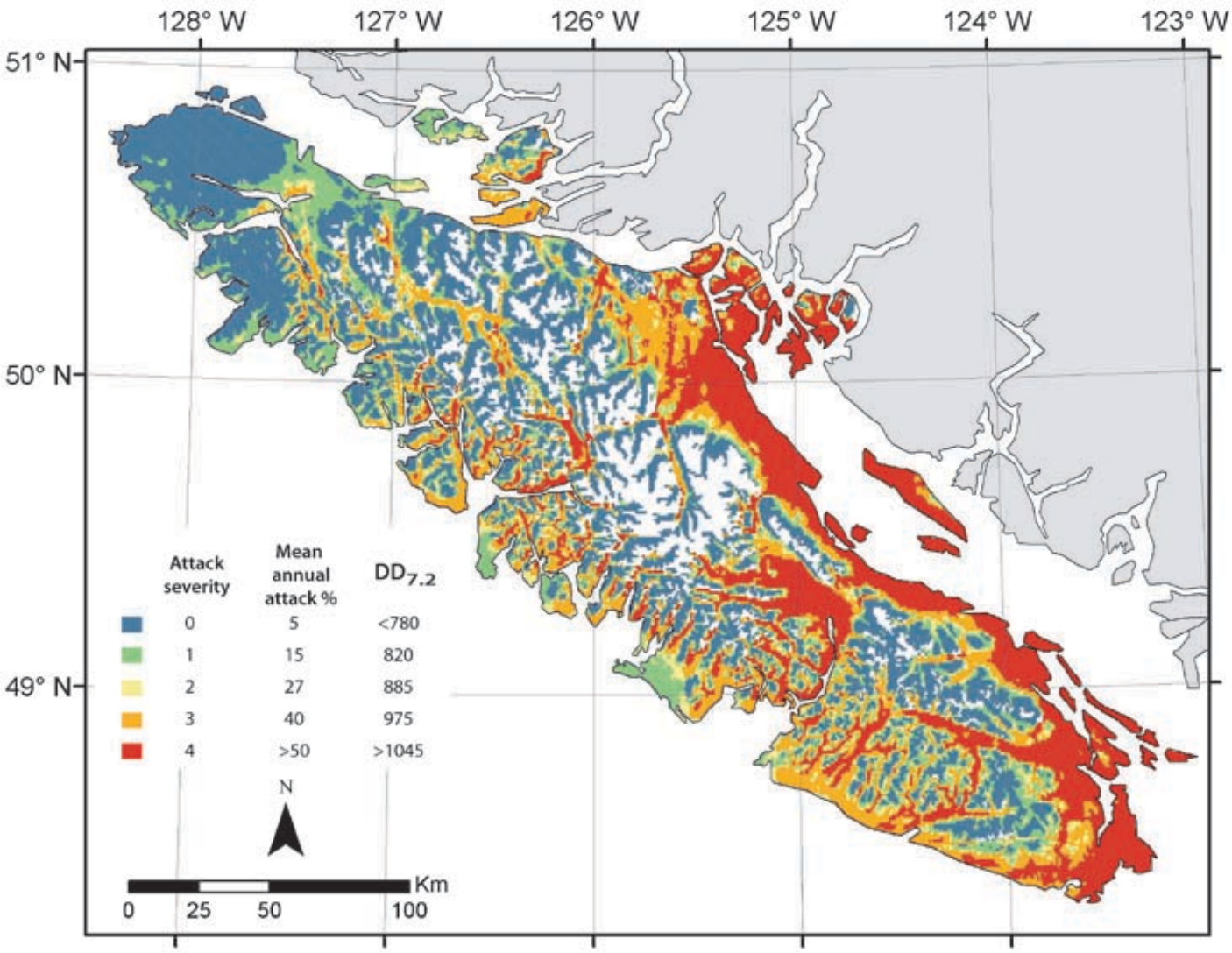

FIGURE 1 *Map of baseline weevil hazard, based on degree days (DD > 7.2°C) and attack rate.*

Significant variables were incorporated into classification tree analysis to aid in development of the web tool and determine how consistently weevil hazard could be predicted by the variables.

Some factors related to hazard that are properties of a given site may be fixed, while others can be mitigated through silviculture. For example, steeper slopes had higher attack severity (hazard), as did lower density stands. While it is not possible to change the slope, the impact can be reduced by reducing the percentage of spruce or selecting alternative species on higher hazard sites. Increasing planting density, retaining some overstorey trees, or allowing broadleaves to establish can all mitigate the hazard by increasing stand density. Many of the variables assessed were closely correlated with each other, such as abundance of understorey species that indicate richer sites, deeper soils, and richer soil nutrient regime. For each suite of highly correlated ($r \geq 0.5$) variables, only the one that explained the highest proportion of attack severity was included in subsequent analyses.

Using the Tool

The tool is available at www.for.gov.bc.ca/hre/forgen/projects/spruceweevil. In Step 1, enter your site co-ordinates to calculate the degree days for the site, which is associated with a baseline hazard level (Figure 1). In Step 2, assess your site for factors in the table that would raise or lower the hazard level. Click on the hyperlinks to see how each factor influences weevil attack rates. The Silviculture page contains guidance to develop a prescription based on the site hazard category. The Links page contains

further resources. To ensure foresters select the most suitable species for the site, these factors are described with respect to their relationship to weevil hazard by clicking on the hyperlinks for each factor.

Literature Cited

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Citation

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