

Extension Note

BC Journal of Ecosystems and Management

British Columbia's Northern Interior Forest Region

Spruce/White Pine Weevil Stand Establishment Decision Aid

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Introduction

The spruce weevil (*Pissodes strobi*) is a major pest in the Northern Interior Forest Region, affecting the growth and development of interior spruce. Repeated weevil attacks to the leading shoots of young interior spruce trees can result in suppressed height growth and stem deformities. Planting genetically resistant seedlings, appropriate provenances, and mixtures of different species, as well as the use of nurse crops, can help reduce the damage from this pest.

The Stand Establishment Decision Aid (SEDA) format has been used to extend information on a variety of vegetation and forest health concerns in British Columbia. The SEDA presented in this extension note summarizes information about spruce weevil occurrence and management in the Northern Interior Forest Region. Other areas of the province also have spruce weevil hazard information in previously published SEDAs. The first page of the SEDA outlines the characteristics of susceptible stands, hazard ratings for the region's biogeoclimatic zones and subzones, and harvesting and silvicultural considerations. The second page provides general information, the life cycle of the insect, symptoms of attack, and forest productivity implications. A valuable resource and reference list that readers can use to find more detailed information is also included. Most reference material that is not available online can be ordered through libraries or the Queen's Printer at: <http://www.qp.gov.bc.ca>

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KEYWORDS: *forest health; Pissodes strobi; productivity; silviculture; spruce weevil; susceptibility rating; white pine weevil.*

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Spruce/White Pine Weevil – British Columbia’s Northern Interior Forest Region

Characteristics of susceptible stands

- Open, sunlit, fast-growing stands of interior spruce, 8–30 years of age, 0.5–12 m tall, with terminal diameters of 5 mm or more. Denser stands have slightly lower attack rates and subsequent damage results in fewer deformities.
- On warmer sites, high hazard exists where heat accumulation exceeds 820 degree days per year above a 7.2°C threshold. Medium-hazard sites receive 785–820 degree days. Weevil development is incomplete with less than 720 degree days.
- Spruce plantations are at risk if adjacent stands have been heavily attacked.



Hazard ratings

BEC Zone ^a	Drier subzones	Wetter subzones
BWBS	601–800 m mw2 ^e	300–600 m mw2 ^e
CWH	10–600 m (ws1) 60–1000 m (ws2)	0–800 m vm
ICH		350–950 m (mc1) 100–750 m (mc2) 240–1000 m (vc)
SBPS	850–1400 m mc	
SBS	951–1053 m (mk1 ^b) 951–800 m (mk2 ^d) 600–800 m (wk1 ^c) 801–1140 m (wk1 ^c) 750–1100 m (wk3) 500–1100 m (dk)	Below 951 m (mk1 ^b) Below 951 m (mk2 ^d) 801–1100 m (dw3 ^b) 750–800 m (dw3 ^b) 500–1200 m (mc2)

^a See Meidinger and Pojar (1991) for an explanation of Biogeoclimatic Ecosystem Classification (bec) zone, subzone, and variant abbreviations.

^b DeLong et al. (1993).

^c Taylor (1998).

^d DeLong (2004).

^e DeLong et al. (1990).

Hazard Rating Key

Low hazard	Moderate hazard	High hazard

Host: Spruce species

Harvesting considerations

Where spruce weevil hazard exists, consider retaining deciduous regeneration during harvesting or implementing alternative silvicultural systems (e.g., group selection) whenever feasible.

Silvicultural considerations

- Larval feeding kills terminal growth and can therefore cause unacceptable height growth loss and stem deformations as laterals turn upward and compete for apical dominance. Forks, crooks, and heavy branching can result.
- Spruce weevil can greatly reduce stand productivity; however, since the pest is native to the province, management should aim to minimize damage rather than attempt to eradicate it. Impact ranges from reduced height growth, to major crooks and forks affecting final stand volume, to complete failure of spruce plantations.

Plantation establishment and maintenance

- When planting spruce, use appropriate provenances (e.g., refrain from planting high-elevation spruce in low-elevation zones).
- Refer to any spruce weevil hazard rating maps for your area. Plant spruce in accordance with normal species-selection guidelines in low-hazard areas. Low levels of weevil attack are tolerable at the stand level (e.g., ≤ 10% stems attacked per year).
- Avoid spruce monocultures in moderate- to high-hazard areas. If possible, plant alternative non-host species. Species mixes reduce stand susceptibility.
- Plant genetically resistant spruce. Genetically resistant spruce seed, derived from resistant trees selected by the Canadian Forest Service and the B.C. Ministry of Natural Resource Operations, is available from Vernon Seed Orchard #211.
- Plant spruce at higher densities (e.g., 1600 or more stems per hectare) or plant under shade trees or nurse crops. These approaches promote height growth competition with minimal terminal diameter growth and force laterals of attacked spruce to “straighten” quickly, thus minimizing stem deformities. Increased shade cools sites and may reduce weevil survival.
- Refrain from spacing until spruce are approximately 7 m tall and the weevil population has declined. Lower densities enable weevils to more easily locate terminal leaders.
- Consider brush control on sites with high or medium site growth indexes containing vegetation complexes that form overstorey canopies (e.g., cottonwood and aspen). Refrain from brushing sites that have low-lying vegetation canopies (e.g., alder and willow), unless this brush clearly inhibits seedling growth.
- Consult with the regional entomologist before considering direct controls such as a “clip and destroy” of infested leaders.
- Dimethoate (Cygon® 480 EC) is the only chemical insecticide registered against spruce weevil in British Columbia. However, given the number of expensive applications required per tree, it is not used operationally for plantations.

Spruce/White Pine Weevil – British Columbia’s Northern Interior Forest Region

General information

Over 482 367 ha of susceptible spruce plantations exist in the Northern Interior Forest Region. These represent some 5349 plantations (greater than 25 ha) containing more than 50% interior spruce between 8–25 years of age.

An integrated spruce weevil pest management system uses a combination of hazard ratings, genetically resistant stock (if available), and silvicultural control. Direct control may be considered under very limited conditions.

Life cycle and symptoms of attack

- Adults overwinter in the duff and (or) the bark of the previous year’s shoots, crawling or flying to host spruce from late April to mid-July.
- Both male and female adults feed on the bark just below the terminal buds of the previous year’s leader; this causes resin to ooze from small (0.5–1.0 mm) feeding punctures.
- Eggs are deposited in late April to early June in cavities in the bark just below the terminal bud extending down approximately half of the terminal shoot.
- Each egg cavity is plugged with a dark-coloured fecal pellet to protect the eggs. Eggs hatch in approximately 10 days. If only a few eggs hatch, resulting small larvae may be killed by host resin response. Under such circumstances, the terminal shoot may be deformed but not killed.
- Surviving larvae initially feed individually, and then form a “feeding ring” and tunnel down the existing leader—first in the inner bark and then in the phloem (between the wood and the bark). This kills the expanding new leader above and the affected upper portion of the previous year’s leader. The dead top typically droops, turns red, and appears as a “shepherd’s crook,” usually in late August or in September.
- After 5–6 weeks, larvae construct pupal cells (called “chip cocoons”) under the bark with strands of wood in the pith and wood of the stem.
- Most newly developed adults emerge from leaders in August and early September through 2–3 mm wide emergence holes and overwinter in the duff. Late-developing adults may overwinter in the existing dead leaders. A wet, cool summer will retard needle chlorosis and weevil emergence. A dry, hot summer will accelerate needle discoloration and weevil development.
- Previously attacked spruce may have numerous dead, imbedded leaders and laterals competing for apical dominance that can cause a “candelabra-like” top on spruce.

Forest productivity implications

- Effects on tree form and volume will depend on infestation severity and duration. Damage includes reduced height growth, leader mortality, heavy branching, stem deformation, and possible volume loss and increased susceptibility to decay organisms.
- Although volume may not be substantially affected in some attacked stands, sawlog lumber recovery from chronically attacked trees is a concern due to stem deformations and heavy branching.
- Evaluation of weevil incidence and management options can be interpreted by use of the Spruce Weevil ATtack (SWAT) Decision Support System developed by the Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C., in collaboration with the B.C. Ministry of Natural Resource Operations. However, these evaluations are conducted by the latter, and are currently not available to outside users.



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Test Your Knowledge . . .

Spruce/White Pine Weevil Stand Establishment Decision Aid

How well can you recall some of the main messages in the preceding Extension Note?
Test your knowledge by answering the following questions. Answers are at the bottom of the page.

1. Where on spruce do adult spruce weevils feed?
 - A) On newly expanding shoots
 - B) On the bark of the stem just below the existing terminal bud
 - C) At the bottom of the existing leader
 - D) In notches between branches

2. Spruce stands susceptible to spruce weevil:
 - A) Are less than 8 years old
 - B) Exceed 12 m in height
 - C) Have terminal stem diameters exceeding 5 mm
 - D) Are 30 years of age or older

3. Which of the following silvicultural practices lower stand susceptibility to spruce weevil attack?
 - A) Planting densities of 1600 stems per hectare of spruce or more
 - B) Planting genetically resistant spruce
 - C) Avoiding monocultures of spruce
 - D) All of the above
 - E) None of the above

ANSWERS

1. B 2. C 3. D