

Jack Pine Budworm

Choristoneura pinus pinus Freeman

Lepidoptera: Tortricidae

Hall, R. J.; Volney, W. J. A.; Wang, Y. 1998. Using a geographic information system (GIS) to associate forest stand characteristics with top kill due to defoliation by the jack pine budworm. *Canadian Journal of Forest Research* 28: 1317-1327.

Objective: To relate stand characteristics with top kill by *C. pinus pinus* using a geographic information system (GIS).

Abstract: The jack pine budworm, *Choristoneura pinus pinus* Freeman, is a native, periodically significant defoliator of jack pine, *Pinus banksiana* Lamb., in North America. Top kill is common during outbreaks, but tree mortality is rare unless infestations coincide with periods of drought.

Using 1:900 and 1:2500 large-scale color photographs from a forested area in Saskatchewan, Canada, top kill by *C. pinus pinus* was categorized into discrete levels of severity according to a classification system devised by the authors (Table 1). Forest inventory maps were converted in GIS for spatial analysis of stand characteristics of age, height, crown closure, and site quality. Maps of top kill and stand characteristics were analyzed spatially to identify stands vulnerable to damage by *C. pinus pinus*. Overall, site quality was strongly associated with top kill by *C. pinus pinus* ($\chi^2 = 350.4$; $\alpha = 0.05$), followed in ranking by stand maturity ($\chi^2 = 328.9$; $\alpha = 0.05$) and stand height ($\chi^2 = 294.3$; $\alpha = 0.05$). Stands associated with moderate and severe top kill were overmature (>85 years), 15-20 m tall, with 31-55% crown closure and established on sites with poor quality. Land managers should consider treatment or harvest options for stands with these characteristics to avoid or limit top kill by *C. pinus pinus*.

Sampling Procedure: Using a GIS, convert 1:12,500 scale forest inventory maps of the area under study from vector to raster with a cell size of 12.5 m. Classify forest cover polygons separately according to stand age, stand height, and crown closure. Stand age classes can be condensed to young (25-35 years), mature (45-65 years), or overmature (85-125 years). Assign site quality by interpreting landform and plant community patterns from 1:12,500 and 1:5,000 infrared aerial photographs of the area. Randomly establish field plots of approximately 300 m² within the area being mapped. At each field plot, record data on the plot location, soil profile, vegetative community, drainage, slope, aspect, and other related measurements. Produce a map of site quality using this field information and 1:25,000 large-scale color photographs. Map the distribution of stand maturity, height, and crown closure as a ratio of the area relative to the entire study area.

Stands identified as >85 years old, 15-20 m tall, with 31-55% crown closure and established on sites with poor quality should be harvested to avoid or limit top kill by *C. pinus pinus*. Stands with these structural characteristics were associated with moderate and severe ratings of top kill (Table 1).

Notes: The authors established 27 field plots within the 44-km² study area. Refer to the original publication for more details regarding mapping stand characteristics within GIS.

Table

Table 1. Top-kill map classification system.

Severity rating	Class limits (%)	Description
Nil	0	No visible top kill
Light	1-25	Up to 25% of trees in delineated polygons with visible top kill
Moderate	26-50	From 26 to 50% of trees in delineated polygons with visible top kill
Severe	51-100	>50% of trees in delineated polygons with visible top kill
Unclassified	Not applicable	Regenerating areas or areas not supporting forest stands

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