

Jack Pine Budworm

Choristoneura pinus pinus Freeman

Lepidoptera: Tortricidae

Volney, W. J. A. 1992. The distribution and estimation of jack pine budworm defoliation. *Canadian Journal of Forest Research* 22: 1079-1088.

Objective: To streamline estimation of defoliation by *C. pinus pinus* on current year shoots and to estimate defoliation levels at a level of fixed precision.

Abstract: Jack pine budworm, *Choristoneura pinus pinus* Freeman, is an important defoliator of jack pine, *Pinus banksiana* Lamb., and to a lesser extent on red pine, *P. resinosa* Ait., in the Great Lakes region and Canada. Extensive top kill is common during outbreaks, but tree mortality is rare unless infestations coincide with periods of drought.

Defoliation by *C. pinus pinus* varies among stands, among trees, and within tree crowns. This variation was quantified and used to determine sample sizes needed to estimate defoliation levels with fixed levels of precision. Ten shoots from a 45-cm branch are used to estimate defoliation levels. The number of plots, trees, and branches needed to estimate *C. pinus* defoliation levels to within 5% of the true mean varied with the mean of the true defoliation levels. In general, the least amount of total effort was needed if true defoliation levels were <10 and >80%. Depending on the defoliation level in the stand, between 3 to 6 h are needed to complete the survey.

Sampling Procedure: Refer to Table 7 for the appropriate number of plots, trees, and branches to sample. Randomly select trees within plots and branches on trees, although systematic sampling of trees along a transect may be more appropriate than random selection given the variation in defoliation that occurs within a stand. Each sampled branch should be at least 45-cm in length. Branches sampled from the middle third of the live crown produce defoliation estimates with the smallest sampling bias. Estimate the defoliation level of 10 randomly selected shoots on each branch following the method of Fettes (1950). The Fettes method estimates defoliation of shoots in 10% defoliation level classes. Average the estimates of defoliation level among trees within a stand to determine stand defoliation levels within 5% of the true mean.

Notes: The 5% level is very precise and might not be efficient for surveys of large areas for management purposes. This procedure could be used to estimate *C. pinus pinus* density (see Nealis and Lomic 1996, this volume).

References

- * Fettes, J. J. 1950. Investigations of sampling techniques for population studies of the spruce budworm on balsam fir in Ontario. Annual Rep. 1949. Sault Ste. Marie: Canadian Forest Service, Forest Insect Laboratory; 11 p.
- # Nealis, V. G.; Lomic, P. V. 1996. Forecasting defoliation by the jack pine budworm. Frontline Tech. Note 91. Sault Ste. Marie: Natural Resources Canada, Canadian Forest Service; 4 p.

Table

Table VII. Optimal allocation of effort in a sample scheme to estimate stand defoliation with a standard error of 5% of the mean.

Percent defoliation	Number of sample units*			Time [†] (min)
	Plots	Trees	Branches	
10	9	1	2	185
20	10	1	2	215
25	9	2	1	217
30	8	2	1	236
40	4	6	1	302
50	3	9	1	363
60	3	9	1	370
70	3	8	1	343
80	3	5	1	275

* Number of units was rounded to the next highest integer.

[†] Estimated time required to complete assessment.

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