

## Douglas-Fir Tussock Moth

*Orgyia pseudotsugata* (McDunnough)

Lepidoptera: Lymantriidae

Mason, R. R. 1987. Frequency sampling to predict densities in sparse populations of the Douglas-fir tussock moth. *Forest Science* 33: 145-156.

**Objectives:** To derive and compare two models for estimating density from  $p$ ; and to determine which is most versatile over a wide range of larval ages and densities.

**Abstract:** The Douglas-fir tussock moth is a major defoliator of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, and true firs, *Abies* spp., in western North America. Outbreaks occur quite unexpectedly so that a large number of trees are often defoliated before direct control measures can be applied. Growth loss, top-kill and tree mortality are common during outbreaks. The density of insects in the mid-crown is the standard expression of abundance for analysis and management of *O. pseudotsugata* populations.

Procedures (Mason 1977, 1978, 1979) have been developed for predicting mid-crown densities of first and second instar larvae by sampling the lower crown where foliage is examined easily without destructive sampling methods. In that scheme, a value  $p$  (proportion of samples containing at least one insect) was estimated from examination of lower crown branches, and translated into mid-crown density by a correction factor for the vertical distribution of larvae within crowns (Mason 1977). Mid-crown densities calculated from mean proportions from the lower crown ( $M = -17.754d^{-0.598} \ln(1 - p)$ ) and densities from direct mid-crown sampling compared favorably. A chi-square goodness-of-fit test between calculated and observed values indicated density estimates from the two sampling methods did not differ significantly ( $P < 0.005$ ). The model based on lower crown samples is therefore recommended for use as density estimations are easier to obtain than direct sampling of the mid-crown. It is also applicable to any sample of which average insect age is known or can be approximated.

**Sampling Procedure:** Take three lower crown samples from 12-15 trees in 10 1-ha plots. Accessible limbs are sampled by beating the distal 45-cm of each branch over a drop cloth to dislodge insects. Determine the number of sample units with one or more tussock moths present and the proportion ( $p$ ) of infested trees. The theoretical model is then used to calculate the mean number of insects per square meter of branch area to derive a mid-crown population estimate:

$$M = -17.754d^{-0.598} \ln(1 - p),$$

where  $d$  is the average age in days since egg hatch (if predominant instar is between classes use midpoint):

Instar I	5
Instar II	15
Instar III	25
Instar IV	35
Instar V	45
Instar VI	55
Pupae	60

**Note:** The models were developed for low density populations of *O. pseudotsugata*.

#### References:

- \*Mason, R. R. 1977. Sampling low-density populations of the Douglas-fir tussock moth by frequency of occurrence in the lower tree crown. Res. Pap. PNW-216. Portland, OR: *U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station*; 8 p.
- \*Mason, R. R. 1978. Detecting suboutbreak populations of the Douglas-fir tussock moth by sequential sampling of early larvae in the lower tree crown. Res. Pap. PNW-238. Portland, OR: *U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station*; 9 p.
- \*Mason, R. R. 1979. How to sample larvae of the Douglas-fir tussock moth. Agric. Handb. 547. Washington, DC: *U.S. Department of Agriculture, Forest Service*; 15 p.