Douglas-fir Beetle

Dendroctonus pseudotsugae Haldeman
Coleoptera: Curculionidae

Negrón, J. F.; Schaupp, W. C.; Johnson, E. 2000. Development and validation of a fixed-precision sequential sampling plan for estimating brood adult density of *Dendroctonus pseudotsugae* (Coleoptera: Scolytidae). Canadian Entomologist 132: 119-133.

Objective: To develop a sequential estimation plan for the assessment of *D. pseudotsugae* population trends.

Abstract: The Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins, is a serious insect pest of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, in western North America. Large populations of this bark beetle can destroy vast areas of Douglas-fir. Sampling procedures for Douglas-fir beetle attacking Douglas-fir are time-consuming. A sequential estimation procedure was developed to address this issue.

Log variance was related positively to log mean *D. pseudotsugae* brood adults (log variance = 0.491 + 1.687(log mean); r^2 = 0.54). The intercept and slope from this equation was fitted into the equation given by Green (1970) to produce the sequential sampling stop lines at the 0.1, 0.2, and 0.3 levels of fixed precision. The number of samples required to estimate *D. pseudotsugae* populations, across all beetle densities, was 91, 20, and 8 at the 0.1, 0.2, and 0.3 levels of fixed precision, respectively.

Sampling Procedure: Identify the stand or area to be sampled. Throughout the stand, randomly select trees successfully attacked by *D. pseudotsugae* and with a diameter of at least 25.4 cm. Remove a vertically oriented sample of bark 30.5 long by 15.25 cm wide from the south side of the tree. Collect samples at 1.37 m above ground. Chill samples until they can be processed. Dissect and examine each bark sample and tally all brood adults and gallery starts present in the sample. Reference Fig. 2 and continue sampling additional trees until the line of the desired level of fixed precision is crossed, at which point sampling is stopped. A precision level of 0.2 may be adequate for monitoring *D. pseudotsugae* populations in order to make management decisions.

After sampling has stopped, calculate the emergence ratio for the stand using the following formula:

$$\text{Stand emergence ratio} = \frac{\text{cumulative number of brood adults}}{(\text{cumulative number of gallery starts} \times 2 \text{ beetles})}$$

Land managers should consider management strategies for *D. pseudotsugae* when increasing emergence ratios signal the presence of growing pest populations.

Note: Data were collected from a few sites in Colorado. Use this plan with caution until it can be validated with data from other areas where *D. pseudotsugae* is present.

Figure

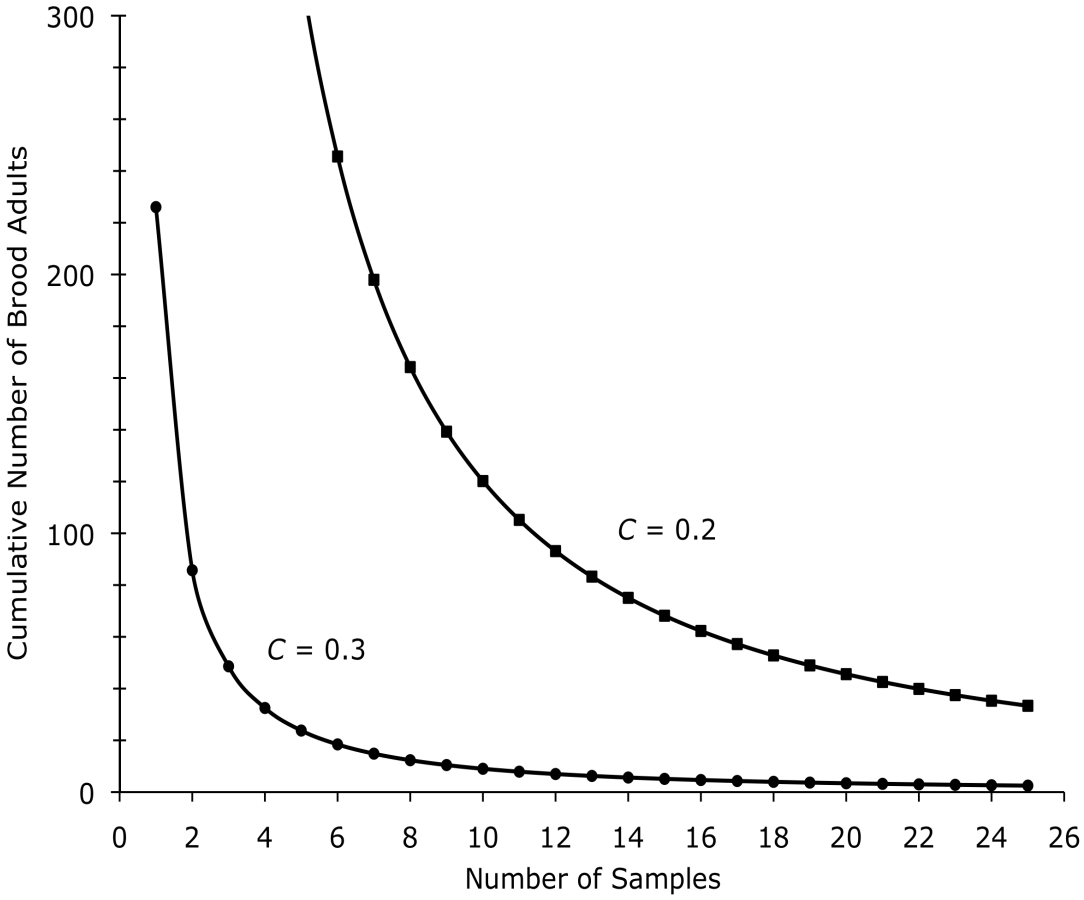

Fig. 2. Sequential sampling stop lines for *Dendroctonus pseudotsugae* brood adults in 30.5 cm x 15.2 cm (0.046 m^2) samples with precision levels (*C*) of 0.2 and 0.3, Pike-San Isabel National Forest, Colorado, 1997–1998.

Figure 2 modified and reproduced with permission by the authors, granted April 16, 2009. The *C* = 0.1 level of fixed precision, found in the original publication, has been omitted due to the large sample sizes required to estimate densities of brood adults.