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**DWARF MISTLETOE INFECTION FROM RESIDUAL  
WESTERN HEMLOCK ON CUTOVER STANDS**

by  
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ABSTRACT

The percentage of dwarf mistletoe-infected hemlock trees within 30 ft of an infected residual overstory tree increased rapidly with age of the stand. Infected unmerchantable trees should therefore be destroyed during or as soon after harvest as is possible.

KEYWORDS: Parasites (plant) (- forest damage, dwarf mistletoe, *Arceuthobium tsugense*, western hemlock.

Until recent years, hemlock dwarf mistletoe was generally not considered an important problem by most forest managers. Infected residual trees were not removed during or after clearcutting. As a result, regenerated stands on thousands of acres of Federal, State, and private lands are now becoming

infested with dwarf mistletoe from residual trees. Smith (1966) stated that as few as 10 evenly spaced infected residual trees per acre are sufficient to reinfest the trees on an entire acre. Land managers, responding to recent publications (Shea and Stewart 1972, Smith 1969) and efforts by pest control pathologists, now want to remove residual infested trees. This raises the question--when do the new stands become so infested that it no longer pays to make a special entry into the stand to remove the residuals?

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Hawksworth and Graham (1963), working with lodgepole pine, showed the percentage of understory trees infected to be correlated with stand age. This paper reports an attempt to correlate the percentage of infected young hemlock with stand age.

### Methods and Materials

Transects, 10-ft-wide by 30-ft-long, radiating from the bases of infected residual overstory trees, were established in pure hemlock stands ranging in age from 10 to 25 years. Smith (1966) shows that over 95 percent of the mistletoe seeds dispersed from an overstory tree fall within 35 ft of the tree. Density varied from 725 trees per acre in the lightest stocked transects, to 18,705 trees per acre in the most heavily stocked transects. The

stands were located on lands managed by the Bureau of Indian Affairs, U.S. Forest Service, and Crown-Zellerbach Corporation in western Washington and Oregon. A total of 39 overstory trees and 52 transects were used. Data were averaged when there was more than one transect for an individual overstory tree.

Each tree within a transect was examined for the presence of dwarf mistletoe shoots. Stand age was determined by counting annual rings of a few trees cut at the ground line.

### Results and Discussion

Within 30 ft of an infected residual overstory tree, the percentage of trees visibly infected with dwarf mistletoe increases with age of the stand (fig. 1). Although the relationship is highly

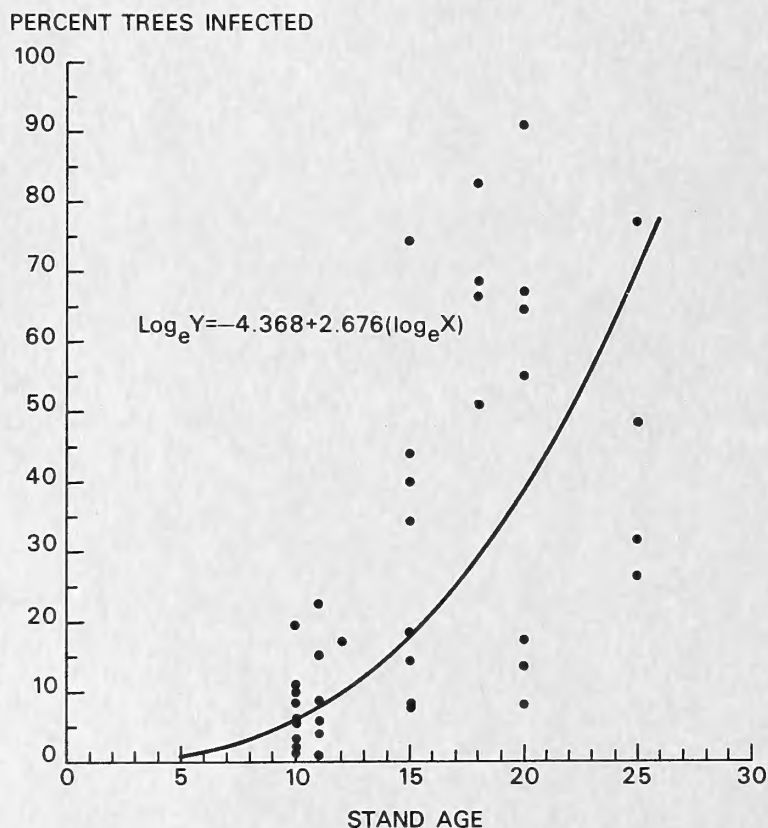


Figure 1.--Percentage of infected trees within 30 ft of a residual infected overstory tree by age of the stand.

significant, less than 50 percent of the variation is accounted for by stand age. The unaccounted variation could be due to other factors influencing infection such as stand density, tree size, or inoculum in overstory trees. These factors were not included in the analysis because of extreme variation. Although the equation,  $\log_e Y = -4.368 + 2.676 (\log_e X)$ , cannot be used as a precise estimator of percentage of trees infected, it does show the trend of rapid increase in percentage of trees infected with stand age. The equation stresses the importance of eliminating all infected residuals at or soon after the time of harvest.

In stands 20 years and older, residual overstory trees were difficult to locate because of the density and height of the stand. Barnes (1962) gives the average height of dominant and codominant trees at 20 years on site index 150 as 31 ft. In such stands, residuals could be spotted from roads, on aerial photos, or from opposite slopes--but only with great difficulty from within the stand. Under these circumstances, residual tree removal is impractical except when done during thinning or other cultural operations.

Residual tree removal as a separate operation is practical in stands 15 to 20 years of age or younger; but even in these stands, it may be advantageous to combine residual tree removal with pre-commercial thinning. Priority for residual tree removal depends on the manager's objective for the area. Youngest stands should have priority if the goal is to reduce dwarf mistletoe infection to a minimal level on as many acres as possible. Older stands should have priority if the goal is to prevent infection from reaching moderate levels. The number and distribution of residuals per

acre should also be a criterion for setting priorities in stands under 20 years of age. Stands with a greater number of residuals per acre should be given higher priority than those with fewer residuals.

### Acknowledgment

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