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OF RESIDUAL PONDEROSA PINE STANDS X

By

Philip C. Johnson, Entomologist

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Intermountain Forest and Range Experiment Station
Ogden, Utah

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Philip C. Johnson, Entomologist
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Increasing use of sanitation-salvage cuttings^{1/} is being made in old-growth ponderosa pine stands in the northern Rocky Mountains to minimize tree mortality from bark beetles while the stands await final harvest or utilization, often as much as 30 years later. The degree of beetle control achieved by sanitation-salvage cuttings depends somewhat upon the severity of damage to residual trees during logging.

Several types of residual tree damage can occur from various phases of logging involved in sanitation-salvage cuttings (table 1). Some damage is inevitable and a reasonable amount may not materially reduce the beetle control benefits of these relatively light cuts. It is the damage in excess of this amount that substantially reduces cutting benefits. Regardless of its cause, the effect of the damage renders the residual trees more susceptible to beetle attack despite their original low risk rating. This effect is more immediate when bark scuffing, top breakage, or fire scorching has occurred because these injuries cause the release of oleoresinic odors from the trees. Bark beetles are readily attracted to these trees and the chance is good that some of them will be attacked and killed within a year or two following the cuttings. Other types of damage cause more gradual increase in the beetle risk rating or susceptibility of trees and several years may elapse before some of them are attacked and killed.

A recent observation illustrates how logging damage may contribute to reduced beetle control benefits of sanitation-salvage cuttings. Continuous cuttings of this nature were made during the period 1949-1951 over most of a large tract of pine in western Montana to lessen the possibility of subsequent beetle-caused tree mortality as well as to achieve certain silvicultural objectives. Timber markers received special training and supervision in the use of the risk rating system

^{1/} Cuttings designed to remove from 15 to 35 percent of the pine stand made up of Risk 3 and Risk 4 trees of the Ponderosa Pine Risk Rating System. These are trees currently susceptible to attack by the western pine beetle, Dendroctonus brevicomis Lec. Their cutting and utilization removes the normally favored breeding place of the beetles, thus helping to prevent the buildup of epidemic beetle populations for a period of years. In addition a few trees are cut for silvicultural or management objectives or because they will not survive from causes other than beetles.

Table 1. Kinds of residual tree damage caused by logging operations

Kind of damage	Logging phase	Cause
Bark scuffing	Spur road construction Felling Skidding	Ricocheting debris from blasting Improper sawing or wedging of felled trees Jammer cable burns Siwashing logs Scraping by tractors or arches Scraping of roadside trees by wide loads
Top or limb breakage	Felling	Improper sawing or wedging of felled trees
Girdling	Skidding and loading	Insufficient shimming of jammer cables anchored to residual trees
Root destruction	Spur road construction Skidding Slash piling	Digging bulldozer blades or power shovel buckets on right-of-way clearing and grading Plowing action of jammer-skidded logs Soil scarifying action of bulldozer blade or teeth
Fire scorching	Slash burning	Slash piled too close to residual trees

and the trees marked for cutting were judged by forest entomologists to adequately provide for the beetle control features of the cutting objectives. All high beetle risk (low vigor) trees were cut and milled, leaving only trees of low risk (high vigor) in all diameter and age classes.

A total of 66 percent of the original pine volume, or an average of 9,990 board feet per acre, was left to form the residual stand after the cuttings. Of this amount, 617 board feet per acre, or 6.2 percent, was damaged to varying degrees during logging (table 2). Damage consisted mostly of the scuffing off of large areas of bole bark and the crushing of the cambium layer in these areas by cable "burning" during skidding operations (fig. 1). Less evident was some top bole breakage and crown damage during felling.

Table 2. Severity of logging damage to residual trees in a large-scale sanitation-salvage cutting in Montana, 1949-1951. (Per acre).

Risk rating	Residual pine stand			Amount of damage		
	Number of trees	Volume b.m.	% Original volume	Number of trees	Volume b.m.	% Residual volume
1	2.6	1,520	71.3	0.5	76	5.0
2	14.8	8,470	87.1	1.4	541	6.4
3	None					
4	None					
Totals	17.4	9,990	66.0	1.9	617	6.2

The dispersal of these trees throughout the residual stand may serve to build up beetle populations which the cutting was designed to suppress. Hence, it is of utmost importance that logging damage to residual trees be eliminated insofar as possible in sanitation-salvage cuttings or in any kind of selection cutting where residual pine stands are to be free of beetle-caused damage. Whenever beetle protection of residual ponderosa pine stands is a major objective of cutting, extra care in logging is needed. This can best be achieved by pre-cutting planning, better supervision of all aspects of logging, especially felling and skidding, and by the cooperation of all logging personnel. It is believed that better cooperation will come from a full acquaintance of the personnel with the cutting objectives relating to bark beetle control.

Figure 1.--Bark scuffing damage to residual ponderosa pine tree sustained during the log skidding phase of a sanitation-salvage cutting operation in western Montana. Largely as a result of the damage to the bole and the resultant decrease in vigor, the beetle risk of the tree increased from moderate (Risk 2) in 1949 to high (Risk 3) in 1953. (CdA 1637).