

Longevity of Snags and Their Use by Woodpeckers¹

Evelyn L. Bull²

Abstract.--Fifty percent of the ponderosa pine (Pinus ponderosa) snags and 38% of the lodgepole pine (P. contorta) snags were standing 8 years after being killed by the mountain pine beetle (Dendroctonus ponderosae) in northeastern Oregon. Trees greater than 50 cm dbh stood longer than smaller trees. Woodpeckers excavated cavities in 15 of the 186 ponderosa pine snags 3 to 8 years after the trees died.

INTRODUCTION

The value of snags to wildlife for nesting, feeding, and perching has been well documented (McClelland and Frissell 1975, Mannan 1977, Thomas et al. 1979, Raphael 1980). Because of their condition, size, or location, however, different types of snags have different values for cavity nesters.

In managed forests, the desired number and kinds of snags can probably be maintained only by deliberate action by resource managers. Information on the number of live and dead trees in a stand, mortality rates, and the rate at which snags fall are needed to predict snag density over time (Bull et al. 1980; Cimon, in press). The time a snag stands, however, is a function of size, rate of decay, species, and cause of death. Few studies have reported the rate at which snags fall (Keen 1929, 1955; Dahms 1949; Lyon 1977; Van Sickle and Benson 1978). My objectives were to determine: (1) how long ponderosa pine and lodgepole pine trees killed by the mountain pine beetle will stand and (2) how woodpeckers use these snags.

METHODS

The study was conducted on the USDA Forest Service (Pacific Northwest Region) Starkey Experimental Forest 35 km southwest of La

Grande, Oregon. This area contains 11 400 ha of mixed conifer forest interspersed with grasslands at elevations of 1 070 to 1 525 m. An outbreak of mountain pine beetle during 1973-80 had killed thousands of lodgepole pine and ponderosa pine trees in the area.

From 1975 to 1977, I marked and measured dbh (diameter at breast height) of 50 lodgepole pine and 186 ponderosa pine trees. I selected trees that had been killed the previous year by bark beetles as indicated by the presence of pitch tubes and brown needles.

Each summer from 1975 to 1982, I recorded the condition of trees (standing, down, or broken) and evidence of feeding and nesting by woodpeckers for each marked tree. In addition, the following characteristics were recorded for 50 lodgepole and 50 ponderosa pines: percent of original bark and needles remaining and the amount of treetop broken off. Snags were grouped in three diameter classes: 25 cm, 25-49 cm, and >50 cm.

RESULTS AND DISCUSSION

Rate of Fall

No snags fell until the third year after death, and ponderosa and lodgepole pines in the same diameter classes fell at similar rates (figs. 1 and 2). Larger snags fell at a lower rate than smaller ones.

Rate of fall reported in the literature varies (table 1). A variety of conditions including cause of death, soil type (Keen 1955), and size affected longevity. Fire may either retard decay and allow snags to stand longer (Dahms 1949) or increase the rate of fall because no live trees remain to reduce

¹ Paper presented at the Snag Habitat Management Symposium, Flagstaff, Arizona, 7-9 June 1983.

² Evelyn L. Bull is Wildlife Biologist, USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Range and Wildlife Habitat Laboratory, La Grande, Oreg.

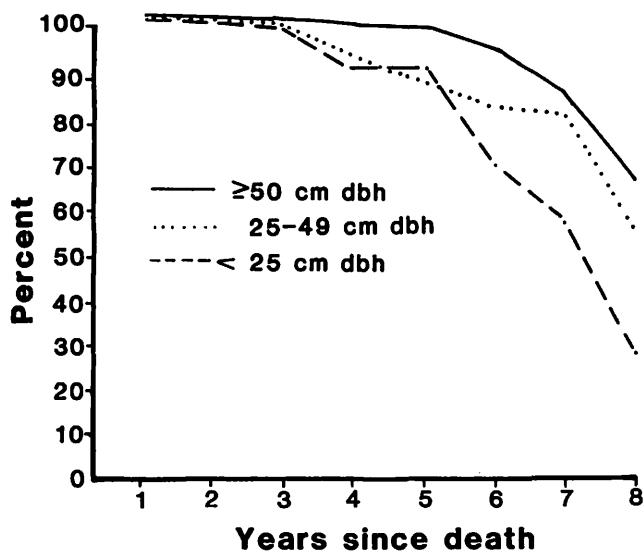


Figure 1.--Percentage of ponderosa pine snags standing, by number of years since death and diameter class, Starkey Experimental Forest, 1975-82.

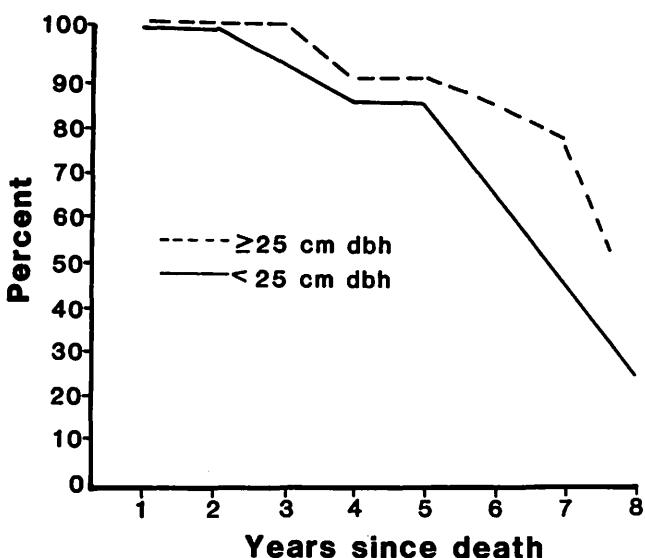


Figure 2.--Percentage of lodgepole pine snags standing, by number of years since death and diameter class, Starkey Experimental Forest, 1975-82.

wind velocities (Lyon 1977). Keen (1955) reported that soil conditions influenced the rate of fall more than did cause of death.

Keen (1929, 1955) and Dahms (1949) agree that large snags fall at a lower rate than

small snags. Because sapwood is more susceptible to decay than heartwood, trees with a thicker core (larger diameter) of heartwood decay slower and stand longer.

Woodpecker Use

There was evidence of feeding by woodpeckers on 82% of the ponderosa pine snags and 92% of the lodgepole snags within the first year after the trees were attacked by bark beetles. Woodpeckers chipped the bark off (scaled) the trunks to obtain bark beetles or larvae. The bark beetle larvae generally remained in the tree 1 year before they developed into adults and moved to a new host tree.

An average of 21% of the trunk surface of the lodgepole pine and 3% of the ponderosa pine was scaled. The lesser amount of activity on the ponderosa pines was probably due to lower insect densities or reduced accessibility because of thicker bark. The scaling occurred on the lower or middle third of the tree trunk on 83% of the trees used by the woodpeckers.

Size of tree, time since death, and broken tops were important in the selection of nest trees. Woodpeckers excavated cavities in 15 of the 186 ponderosa pine snags within the 8 years (table 2). No cavities were found in lodgepole pines or ponderosa pines less than 25 cm dbh. The mean dbh of snags with cavities was 52 cm, which indicated a preference for large diameter trees.

Cavities were excavated in snags that had been dead 3-8 years. Some nest cavities were reused and new nests were excavated in some snags in successive years. Northern flickers (*Colaptes auratus*), Williamson's sapsuckers (*Sphyrapicus varius*), hairy woodpeckers (*Picoides villosus*), and white-headed woodpeckers (*P. albolarvatus*) were observed nesting.

The tops were broken out of 13 of the 15 snags used for nesting. Seventy-seven percent of the cavities occurred within 2 m of the broken top. Woodpeckers excavated here because the wood was probably decayed. Either the break occurred because the wood was already decayed or the wood began decaying when it was exposed by the break. The average cavity height was 16 m. Trees with cavities had 21% (mean) of the top broken off and retained 98% of their bark.

Physical Characteristics

Over the 8 years, the physical characteristics of the snags changed. The needles turned brown in 1975 but most remained on the tree. In 1976, 12% of the original needles remained; in 1977 less than 3%.

Table 1.--Comparison of snags standing reported in five studies

Snags	Keen (1929)	Dahms (1949)	Keen (1955)	Lyon (1977)	This study
<u>Percent</u>					
Ponderosa pine:					
Standing after 8 years	32	60	32-71		64
Standing (25-49 cm) after 7 years	42 ¹				79
Standing (>50 cm) after 7 years	60				86
Lodgepole pine:					
Standing after 8 years				63	38

¹Diameter class was 25-46 cm.

Table 2.--Percentage and number of ponderosa pine snags
woodpecker cavities and percentage of snags with cavities
that had broken tops

Years since death	Snags 25-49 cm dbh		Snags >50 cm dbh		Snags with broken tops
	Percent	Number	Percent	Number	
1	0		0		0
2	0		0		0
3	0		2	1	0
4	5	4	7	3	86
5	6	4	9	4	75
6	7	5	16	7	92
7	21	4	17	2	100
8	31	4	33	3	100

¹Numbers are cumulative; a reduction means that snags fell or sample size was smaller.

Bark retention decreased from 100% to 96% on the ponderosa pines and from 100% to 89% on the lodgepole pines over the 8 years. The bark on the lodgepole was thin, dried rapidly, loosened, and fell off more readily than on the ponderosa pine. In addition, more bark was removed by woodpeckers on the lodgepole snags.

The most apparent change in the trees was broken tops (fig. 3). Few lodgepole pines but many ponderosa pines greater than 50 cm dbh had tops broken. The average amount of top broken off was 11%; the range, 5-75%.

The difference in breakage between the two tree species was probably due to physical characteristics. Because the lodgepole pine snags were small in diameter and had thin bark, the wood dried rapidly. Even though there was a high percentage of sapwood, the low moisture content retarded decay. At ground level, however, soil moisture was available, the bark was thicker and retained moisture, which probably encouraged decay. The lodgepole, therefore, were more susceptible to breakage at the base than along the stem. In contrast, the bark of the ponderosa pine snags was thicker, retained more moisture, and was therefore more susceptible to decay and breakage along the entire stem.

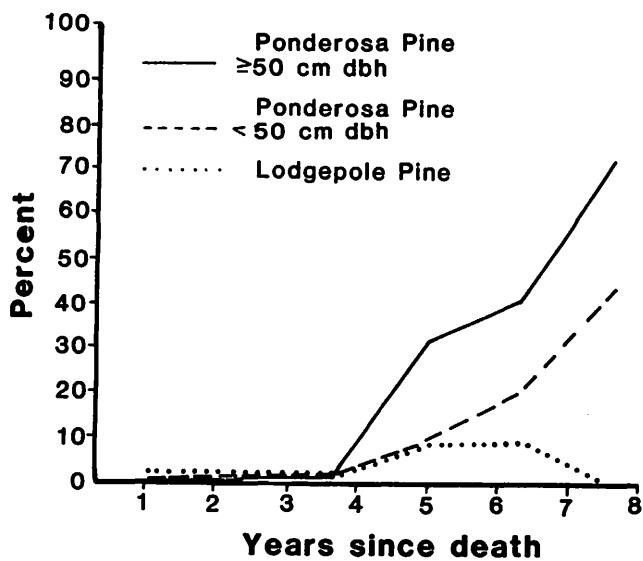


Figure 3.--Percentage of ponderosa and lodgepole pine snags with broken tops, by number of years since death and diameter class, Starkey Experimental Forest, 1975-82.

SUMMARY

Of trees killed by bark beetles in northeastern Oregon, ponderosa pine snags greater than 50 cm dbh stood longer than smaller ponderosa or lodgepole pines. Woodpeckers excavated cavities in larger snags that were dead at least 3 years and had broken tops. The rate of fall of different diameter classes of snags must be considered to provide number of snags over time.

LITERATURE CITED

Bull, Evelyn L., Asa D. Twombly, and Thomas M. Quigley. 1980. Perpetuating snags in managed mixed conifer forests of the Blue Mountains, Oregon. p. 325-336. In Management of western forests and grasslands for nongame birds. Workshop Proceedings. USDA Forest Service General Technical Report INT-86. Intermountain Forest and Range Experiment Station, Ogden, Utah.

Cimon, N. In press. A simple model to predict snag levels in managed forests. In Snag Habitat Management Symposium.

Dahms, Walter G. 1949. How long do ponderosa pine snags stand? USDA Forest Service, Pacific Northwest Forest and Range Experiment Station Research Note 57, 3 p. Portland, Oreg.

Keen, F. P. 1929. How soon do yellow pine snags fall? Journal of Forestry 27:735-737.

Keen, F. P. 1955. The rate of natural falling of beetle-killed ponderosa pine snags. Journal of Forestry 53:720-723.

Lyon, L. Jack. 1977. Attrition of lodgepole pine snags on the Sleeping Child Burn, Montana. USDA Forest Service Research Note INT-219, 4 p. Intermountain Forest and Range Experiment Station, Ogden, Utah.

Mannan, R. W. 1977. Use of snags by birds, Douglas-fir region, western Oregon. M.S. thesis. Oregon State University, Corvallis.

McClelland, B. Riley, and Sidney S. Frissell. 1975. Identifying forest snags useful for hole-nesting birds. Journal of Forestry 73:414-417.

Raphael, Martin G. 1980. Utilization of standing dead trees by breeding birds at Sagehen Creek, California. Ph.D. thesis. University of California, Berkeley. 195 p.

Thomas, Jack Ward, Ralph G. Anderson, Chris Maser, and Evelyn L. Bull. 1979. Snags. p. 60-77. In Wildlife habitats in managed forests--the Blue Mountains of Oregon and Washington. U.S. Department of Agriculture Agriculture Handbook No. 553. (Published in cooperation with the Wildlife Management Institute and the U.S. Department of the Interior Bureau of Land Management.) Washington, D.C.

Van Sickie, Charles, and Robert E. Benson. 1978. The dead timber resource--amounts and characteristics. p. 127-146. In Proceedings of symposium on the dead softwood timber resources. Washington State University, Pullman.