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THE USE OF HIGH-CUT STUMPS BY BIRDS

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The deterioration of short snags or "high-cut stumps" and their use for foraging and nesting by birds were evaluated in the Sierra Nevada between 1984-85 and 1990. Pine stumps deteriorated more rapidly than fir, although the majority of bark was still present after 5-6 years on all species. All conifer species except incense-cedar were heavily used for foraging by birds; however, few nests were excavated in any species of high-cut stump. Almost all stumps showed some sign of arthropod activity. Although high-cut stumps do not serve as adequate replacements for taller snags, they do provide useful foraging and occasional nesting locations in areas where tall snags pose safety hazards or interfere with silvicultural activities. Incense-cedar should not be used, and fir and pine should be emphasized, when creating high-cut stumps.

INTRODUCTION

The use of standing dead trees, or snags, by wildlife is well documented. All Classes of vertebrates have some species that use snags for denning and breeding, as well as feeding substrate because of the arthropod food found in and under the bark (e.g., Thomas et al. 1979, Davis et al. 1983, Raphael and White 1984). Controversy exists, however, over the density and size of snags needed in an area to support populations of snag-dependent wildlife. This controversy occurs because snags occasionally pose fire hazards, interfere with the operation of ground and aerial forestry equipment, and cause property damage or personal injury when they fall near roads, trails, or buildings (see Morrison et al. [1983, 1986] for reviews).

The creation of "high-cut stumps" has been proposed as one way of eliminating some of the safety hazards caused by snags in certain areas, while still providing some shelter, food substrate, and possibly even nesting sites for wildlife (Kroll et al. 1980, Morrison et al. 1983). "High-stumping" creates snags that are short (usually 1-2 m) compared to most natural snags, less hazardous than taller snags, and result in little loss of timber revenue when created from living trees (Morrison et al. 1983). Trees are usually cut at or near ground level during timber harvest.

Morrison et al. (1983) reviewed the use by birds of natural snags in relation to snag height, and they found that about 90% of all cavity-nesting bird species nested in snags >2 m tall. No information was available on the use of stumps for foraging. They recommended that experimental creation of high-cut stumps be initiated to help clarify their use by wildlife. This paper is a follow-up to Morrison et al.'s review and presents original data on the use of high-cut stumps for nesting and feeding by birds.

STUDY AREA

The study area was the University of California's Blodgett Forest Research Station, El Dorado County, California. The 1,200 ha forest (1,200-1,450 m elevation) is in the mixed-conifer zone (Griffin and Critchfield 1972) of the western Sierra Nevada. Predominant tree species are incense-cedar (*Calocedrus decurrens* [Torr.] Florin.), white fir (*Abies concolor* [Gord. & Glend. Lindl.), sugar pine (*Pinus lambertiana* Dougl.), ponderosa pine (*P. ponderosa* Dougl. ex Laws), Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco), and California black oak (*Quercus kelloggii* Newb.). The forest was primarily mature (i.e., >70 years old and >30 cm diameter breast height) second-growth timber divided into 5- to 40-ha compartments and managed under different silvicultural systems. See Morrison et al. (1987) for a more detailed description of Blodgett Forest.

METHODS

Within the guidelines given below, the specific location, spacing, and species composition of each group of stumps was left to the discretion of the forestry operator for logistical and safety reasons and have results with practical application.

High-cut stumps were made with a chainsaw during regularly-scheduled forest operations in mature stands and along the edges of clear-cuttings. Sample sizes were inadequate to divide analyses by stand type. The chainsaw was held as high on the trunk as safety considerations allowed on the uphill side of the slope; no ladder or other support was used to stand above the ground. Bull (1978) and Evans and Conner (1979) indicated that snags in groups are used preferentially to scattered individuals. Therefore, stumps were made in groups of 2-6, although 70% were in groups of 4 (our prescribed goal); stumps in a group were within 10 m of each other. An attempt was made to select different species of trees for each group depending upon the species composition of a site. However, because of their sparse and irregular distribution, oaks were not used for high-stumping. The largest (by diameter) trees present were selected for high-stumping to maximize the chances that birds would use them for nesting and feeding (Mannan et al. 1980, Raphael and White 1984). One group was created in about every 5 ha of forest.

Stumps ($n = 29$ groups and 114 individuals) were created between June 1984 and March 1985. Each stump was individually marked with a numbered tag, and the following data were recorded within 1 month of creation: group and tag number; tree species; diameter at breast height (dbh) or diameter at top of stump if under dbh; height; percent bark cover (visual estimate); hardness (subjective scale from 1 [hard] to 5 [soft] based on observer's ability to thrust a knife into the bark); evidence of feeding activity (i.e., woodpecker excavations); and number of nest cavities. Because only living trees were cut, all stumps began at hardness category 1. Notes were taken on evidence of arthropod activity and fungal decay. Stumps were resurveyed in September 1990 and these same data were recorded. June 1984 to March 1985 data were lumped for comparisons with the September 1990 resurvey.

Table 1. Hardness rating (1 = hard; 5 = soft) in 1990 of high-cut stumps created in 1984-85, western Sierra Nevada, California.

Species	No. of stumps	Hardness rating (%) 1	2	3	4	5
Douglas-fir	29	79	21			
White fir	19	95				5
Sugar pine	21	52	19		19	10
Ponderosa pine	32	38	28		22	13
Incense-cedar	13	92	8			
Total fir[a]	48	85	13			2
Total pine[a]	53	43	25		21	11
Total conifer[a]	114	67	18		10	6

[a]Total fir = Douglas-fir and white fir; total pine = sugar and ponderosa pines; total conifer = all species combined.

Changes in stump characteristics were compared using *t*-tests for paired comparisons (Sokal and Rohlf 1969:328-333).

RESULTS

No significant ($P > 0.5$, *t*-test) differences were found in dbh or height for any species of stump between 1984-85 and 1990. Overall (all species combined) average dbh was 62 cm (SD = 15.4) and height was 145 cm (20.6).

Overall, 34% of the stumps declined from hardness class 1 to hardness classes 2-4 between sampling periods; most (18%) of this decline was to class 2 (Table 1). Among species, most white fir and incense-cedar remained as class 1, and 21% of the Douglas-fir declined to class 2. Almost half of the sugar pine and two-thirds of the ponderosa pine, however, declined to classes 2-4. Thus, only 15% of the total "fir" (combining true fir and Douglas-fir) declined, whereas 57% of the total pine (combining sugar and ponderosa pines) declined in hardness.

Overall, about two-thirds of all stumps showed signs of woodpecker feeding. No other wildlife use was noted. All tree species except incense-cedar showed woodpecker feeding on greater than 50% of the stumps, ranging from a low of 53% for white fir to 75% for ponderosa pine (Table 2). Only 31% of incense-cedar stumps showed signs of woodpecker foraging. Overall by species group, total fir showed slightly less (63% versus 72%) feeding activity than total pine. The sizes and shapes of holes on the bark surface indicated that woodpeckers were excavating into the stumps to remove wood-boring insects such as beetles.

Four nest holes were found: 2 in ponderosa pine, and 1 each in Douglas-fir and sugar pine. The bird species creating the excavations were unknown, but hole sizes indicated white-headed woodpeckers (*Picoides albolarvatus*) may have created the

Table 2. Evidence of feeding by woodpeckers in 1990 on high-cut stumps created in 1984-85, western Sierra Nevada, California.

Species[a]	No feeding (%)	Feeding (%)
Douglas fir	31	69
White fir	47	53
Sugar pine	33	67
Ponderosa pine	25	75
Incense-cedar	69	31
Total fir	38	63
Total pine	28	72
Total conifer	37	63

[a]Species, species categories, and sample sizes defined in Table 1.

cavities, with possible secondary use by mountain (*Parus gambeli*) or chestnut-back (*P. rufescens*) chickadees.

There was a small (13%) but significant ($P < 0.001$) change in bark cover for all species combined between sampling periods (Table 3). By species, the change in bark cover was only 1-5% for incense-cedar, white fir, and Douglas-fir, although the change for Douglas-fir was significantly different ($P = 0.016$) between periods (Table 3). Bark cover on ponderosa pine decreased 20%, whereas that on sugar pine decreased 29% (both $P \leq 0.001$). Thus, bark cover for total fir decreased only 4%, whereas total pine decreased 24%.

About 95% of all stumps showed some signs of arthropod activity (e.g., bore holes, sawdust, pitch tubes), and about 60% showed signs of external sapwood fungal development.

DISCUSSION

These results showed that within the first 5-6 years of creation high-cut stumps are used for foraging; use for nesting was minimal. Findings for deterioration of, and bird feeding activity on, taller snags correspond closely to my results for stumps (e.g., Cline et al. 1980, Mannan et al. 1980, Swallow et al. 1988). Feeding activity should slowly decline as stumps continue to decay and likely become minimal after 10-years post-creation, because most bark will have dropped off and the stump will have become very soft by that time. Nest excavation might continue or even increase 10-15 years post-creation as the interior of stumps soften (Cline et al. 1980).

No obvious relationship was found between decline in hardness, bark cover, and woodpecker feeding activity. Pine decayed the most, but it showed little difference in feeding activity by birds relative to fir. Other studies in the Sierra Nevada have shown that pine decays more rapidly than fir (e.g., Raphael and White 1984, Raphael and Morrison 1987). All species except incense-cedar were used substantially for

Table 3. Decline in bark cover on high-cut stumps between time of creation (1984-85) and 1990, western Sierra Nevada, California.

	1984-85		1990			Percent
Species[a]	$\bar{x}$	SD	$\bar{x}$	SD	P [b]	decline
Douglas-fir	98	8.3	93	10.3	0.016	5
White fir	96	7.3	94	10.4	0.424	2
Sugar pine	95	6.8	67	32.6	0.001	29
Ponderosa pine	97	6.0	78	20.2	<0.001	20
Incense-cedar	100	0.6	99	3.0	0.230	1
Total fir	97	5.8	93	10.3	0.018	4
Total pine	96	6.3	73	26.1	<0.001	24
Total conifer	97	5.8	84	21.7	<0.001	13

[a]Species, species categories, and sample sizes defined in Table 1.
[b]t-test.

foraging. The relative insect resistance and decay patterns of incense-cedar are apparently responsible for its low use by birds. Living incense-cedar is, however, an important foraging substrate for birds during winter (Morrison et al. 1989).

Previous work showed a nesting preference by birds for snags >5 m tall (e.g., see Morrison et al. [1983] for review). Also, although used for foraging, stumps obviously provide much less bark surface area than taller snags. I concur with earlier recommendations (Morrison et al. 1983) that stumps only be used in situations where snags present obvious safety or logistical problems, and they not be considered adequate nest substrates. Both firs and pines can be used for stumping, with a slight preference given to using firs because of their slower decay rate. Incense-cedar should be avoided for use as high-cut stumps, if possible.

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