Wildlife Use of Created Snags in Young Conifer Stands

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INTRODUCTION

The importance of snags (standing dead trees) to wildlife in western forests has been well documented (cite review(s)). A large number of species depend on standing dead wood for nesting, roosting, and foraging sites (e.g., approx 1/3 of forest bird species in western OR; cite). Snag densities have been reduced by past and current management practices that required removal of snags for logistical and safety reasons, and did not provide for the retention or recruitment of future snags under a short-rotation harvest regime (Rose et al. 2001). As a legacy of these practices, large portions of the landscape in western Oregon (Pacific Northwest?) are currently occupied by young conifer forests that have relatively low densities of snags. The deficiency in availability of deadwood habitat has heightened concern over many snag-associated wildlife species, especially for forest managers charged with maintaining habitat for native wildlife species (cite USFS and BLM docs).

Commercial thinning of young managed stands has become an increasingly common practice on federal forest lands in the Pacific Northwest. Thinning has been promoted as a tool for increasing structural diversity in homogenous young conifer stands, and for potentially hastening the development of structural features support species associated with late-seral forest (e.g., northern spotted owl) over the long term. However, thinning is unlikely to increase, and may actually decrease, the number of snags available as habitat for cavity-nesting species. Snag density may be augmented by killing live trees, but the range of diameters of the trees available in young stands from which to create snags may not be adequate for many cavity-using species. Snags < 50 cm dbh are infrequently used as nest or roost sites by cavity-using wildlife in western Oregon (Mellen et al.: DecAID). However, because the current snag deficit calls for testing methods to quickly create snags, the value as wildlife habitat of these relatively small diameter (i.e., <50 cm) trees warrants investigation.

Although thinning is likely to have a negative impact on snag density, some cavity-nesting species have surprisingly demonstrated an increase in abundance following thinning operations. Hairy woodpeckers…

In this study, we investigated decay characteristics and wildlife use of snags created from 36- to 46-cm dbh trees in young stands. The study was overlain on an experimental investigation of the effects of a range of thinning intensities on various resources (the Willamette Young Stand Thinning & Diversity Study; cite) so that we could assess interactions between thinning and snag-creation. Our goal was to quantify the status and use by wildlife of created snags in young, managed conifer forest. Our specific objectives were to 1) compare the frequency of occurrence of decay agents (fungus and insects) between 2 methods of snag creation, 2) compare the proportion of trees used for foraging and nesting between 2 methods of snag creation, and 3) assess the influence of the interaction of thinning intensity and snag-creation method on frequency of decay agents and wildlife use.

We intend to monitor created snags through time to assess the value and longevity of relatively small diameter snags as wildlife habitat.

METHODS

Wildlife Tree Creation and Monitoring

In 2001, two methods were used to create wildlife habitat from live trees in each of the 16 stands in the study: 1) topping with a chainsaw, and 2) topping plus innoculation with heartrot fungus (*Phellinus pini*). Trees treated with each method were paired such that they are within 60' of one another for efficiency in relocation and monitoring. Treated trees were marked with a "wildlife tree" sign on one side, and a numbered, metal tag at the base of the opposite side. The target snag density for each unit was one snag >12" dbh /acre. Trees were treated in all thinning treatments, including control stands. Only Douglas-fir was used because other species occur too infrequently to comprise adequate sample sizes for statistical inference.

Wildlife trees were surveyed for condition, presence of decay agents, and wildlife use in 2007. Data collected on each treated tree included: tree status (living, dead, or fallen), presence of nest cavities and/or foraging sign, presence of insects and fungus, and decay class.

We monitored treated trees with nest cavities for signs of active nests on two visits between 7 June and 5 July, 2007. On each visit, an observer spent 20 minutes at each tree with likely nest cavities and recorded any cavity-nester activity in the vicinity.

Statistical Analysis

We used ANOVA (PROC MIXED in SAS) to test for the effect of tree-kill method (saw or saw + inoculation), thinning treatment, and the interaction of tree-kill method and thinning treatment on the proportion of treated trees with insects, decay agents, sign of foraging by birds, and nest cavities.

We used T-Tests to test for effect of tree diameter on presence of nest cavities. We ran separate T-tests with no grouping, grouped by kill treatment, and grouped by thin treatment.

RESULTS

A total of 722 trees (from 36 to 76 trees/stand) were treated to create wildlife trees, of which 89% (645) were dead (snags) by 5-6 years after treatment. 97% (624) of the dead trees were categorized as decay class 2; the remainders were decay class 1 or were missing a decay classification. 73 treated trees remained alive (41 saw-topped only and 32 saw-topped and inoculated); of these 71 (10% of treated trees) appeared to be healthy. Four of the treated trees could not be found and had probably fallen.

Decay Agents

Trees killed by saw-topping plus inoculation had a higher frequency of use by Douglas-fir beetles (mean=84% of created snags) than trees that were saw-topped only (77%), regardless of thinning treatment (P = 0.02, ANOVA, 12 df; Table 1). Trees killed by saw-topping plus inoculation also had a higher frequency of pouch fungus (mean=39% of created snags) than trees that were saw-topped only (32.5%), regardless of thinning treatment (P=0.05, ANOVA, 12 df; Table 2). The proportion of treated trees used by wood-boring beetles was not related to the tree-kill method nor to the thinning treatment (P = 0.13, ANOVA, 12 df): 69% of saw-topped trees and 71% of sawed and inoculated trees had wood-boring beetles.

Indian paint fungus (n=17 trees), red belt fungus (n=13 trees), and red heart fungus (n=8 trees) occurred too infrequently to assess the effects of tree-kill method and thinning treatment.

Table 1. Proportion (SE) of treated trees with evidence of Bark Beetles.

	Control	Heavy Thin	Light with Gaps	Light Thin
Saw-topped	0.85 (0.052)	0.73 (0.127)	0.70 (0.134)	0.81 (0.087)
Saw + Inoc.	0.90 (0.021)	0.75 (0.093)	0.86 (0.066)	0.84 (0.069)

Table 2. Mean (SE) proportion of treated trees with pouch fungus by kill method and thinning treatment.

	Control	Heavy Thin	Light with Gaps	Light Thin
Saw-topped	0.29 (0.109)	0.29 (0.114)	0.29 (0.115)	0.43 (0.103)
Saw + Inoc.	0.34 (0.153)	0.35 (0.126)	0.32 (0.153)	0.54 (0.153)

Cavity-nesting Bird Use

Foraging

The proportion of trees used for foraging by cavity-nesting birds was greater for trees killed by saw-topping plus inoculation (46%) than for trees that were saw-topped only (40%) (P < 0.01, ANOVA, 12 df). The proportion of treated trees used for foraging did not differ among thinning treatments (P = 0.83, ANOVA, 9 df).

Table 3. Mean (SE) proportion of treated trees with evidence of foraging by woodpeckers, by kill method and thinning treatment.

	Control	Heavy Thin	Light with Gaps	Light Thin
Saw-topped	0.41 (0.093)	0.45 (0.139)	0.32 (0.080)	0.40 (0.152)
Saw + Inoc.	0.52 (0.116)	0.49 (0.113)	0.44 (0.101)	0.40 (0.141)

Average diameter of trees with foraging sign (18.36" dbh, SE = 0.164) did not differ from that of trees with no sign of use by bark-foraging birds (18.14" dbh, SE = 0.130) (P = 0.31, T-test). However, overall variation in dbh in all stands was low. DBH ranged from a minimum of 9.0" to a maximum of 28", with a mean of 18.2" (SD =2.74").

Nesting

Across all thinning treatments, we found a total of 77 trees with nest cavities in 2007. The proportion of trees with nest cavities did not differ between trees killed by saw-topping plus inoculation (12%) and trees that were saw-topped only (10%) (P = 0.271, ANOVA, 12 df). However, there was evidence of an effect of thinning treatment on frequency of occurrence of snags with nest cavities; Control treatment had significantly lower proportion of trees with nest cavities on average than thinned stands (Fig. 1).

The mean dbh of trees with nest cavities across all thinning treatments was 18.39" (SE = 0.333), compared to18.22" (SE = 0.108) for trees without nest cavities (P= 0.601, T-test). The difference in dbh between trees with and without nest cavities was not influenced by thinning treatment (Table 4) nor tree kill treatment.

Fig. 1. Mean (95% CI) proportion of treated trees with nest cavities excavated by primary cavity-nesting birds.

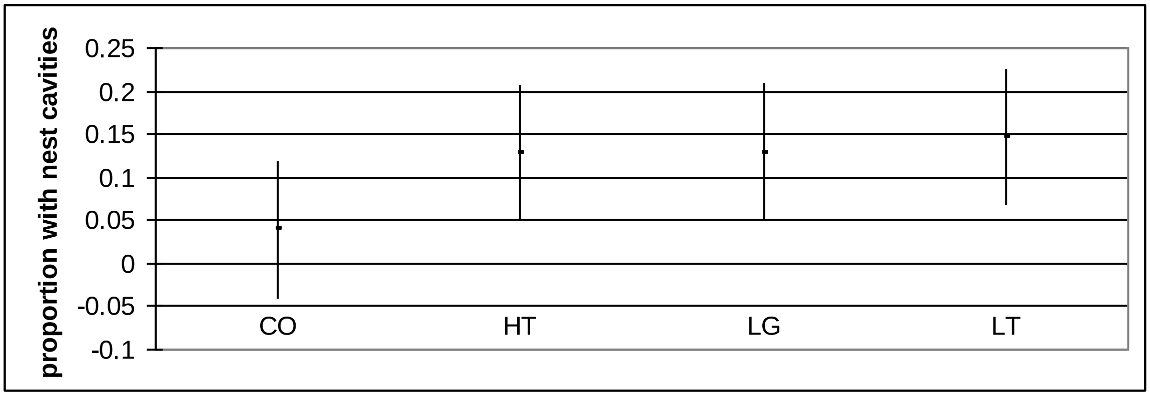


Table 4. Average dbh and standard errors for trees with and without nest cavities in four thinning treatments, Willamette National Forest, 2007.

	Trees without Nest Cavities		Trees with Nest Cavities Present			
	DBH (inches)	SE	DBH (inches)	SE	Diff	P
Control	18.32	0.167	19.17	2.088	0.85	0.702
Heavy	18.69	0.201	19.06	0.444	0.37	0.500
Light w Gaps	16.69	0.254	16.63	0.673	-0.06	0.935
Light	19.20	0.192	19.20	0.379	-0.002	0.996

Only four active nests were found in 2007, and five in 2008. Of these nine nests, only four were in created snags (Table 5). Red-breasted sapsucker used the same created snag, but different cavities, for nesting in the two consecutive years.

Table 5. Active nests of cavity-nesters found in the Young Stand Thinning and Diversity Study, 2007 and 2008.

Bird Species	Year	Thin Treatment	Kill treatment	DBH (in)	Decay	Tree Species	Comments
Red-breasted Sapsucker	2007	LT	Untreated	16	2.5	PSME	Natural snag
Red-breasted Sapsucker	2007	HT	Untreated	10	0	ACMA	Live tree
Red-breasted Sapsucker	2007	LG	SI	20	2	PSME	
Red-breasted Sapsucker	2008	LG	SI	20	2	PSME	Same tree as used in 2007
Red-breasted Sapsucker	2008	HT	Untreated	20	2.5	PSME	Natural snag
Chestnut-backed Chickadee	2007	HT	SI	23	2	PSME	
Chestnut-backed Chickadee	2008	HT	Untreated	30	4	PSME	stump
Chestnut-backed Chickadee	2008	LG	Untreated	40	5	PSME	Old, remnant snag
Red-breasted Nuthatch	2008	HT	S	23	2	PSME	

DISCUSSION

The treatment of live trees with saw-topping alone and saw-topping plus inoculation with a decay agent was successful in creating snags from 89% of treated trees in mid-age (approx. 60-year-old) Douglas-fir stands. The use of inoculum in combination with saw-topping of trees increased the proportion of killed trees that had detectable infestations of bark beetles and pouch fungus. Trees that were both topped and inoculated also had a higher proportion of use for foraging than trees that were only topped. Bark-foraging birds may have been responding to greater availability of bark beetle larvae and other insect prey associated with decaying trees.

The proportion of treated trees with nest cavities was relatively low (< 15 % of treated trees). Most of the active nests found were in snags that exceeded the average diameter of created snags. This suggests that snags created from trees < 20” dbh may not provide suitable nesting habitat for many cavity-nesting species. However, cavities in created snags may be used as cover by small mammals, and may also provide winter roosting habitat for secondary cavity-users. Cavity-using birds need multiple winter roosts/bird, so cavity availability may have an important influence on winter survival.

Thinning treatments did not influence the proportion of treated trees with insects or decay agents, nor the proportion of trees with evidence of foraging by birds. However, a higher proportion of snags in thinned stands had nest cavities than in unthinned (Control) stands. Density of cavity-nesting species as a group has been increasing, especially in thinned stands, since creation of wildlife trees in 2001 (Fig. 2), although response of individual species has varied. The positive response of the cavity-excavating species, hairy woodpecker and red-breasted sapsucker, to thinning (Fig. 2) may explain the higher proportion of nest cavities in thinned stands. The response of the chestnut-backed chickadee, a secondary cavity-nester, to creation of snags may have been delayed (Fig. 2) because this species primarily nests in old cavities, originally excavated by woodpeckers, in stems with more advanced decay. On the other hand, densities of red-breasted sapsuckers may be declining after having reached a maximum between 2001 and 2006 (Fig. 2). This species uses excavates nest cavities in hard snags or live trees. As decay advances, created snags will likely become less suitable as nest sites for sapsuckers.

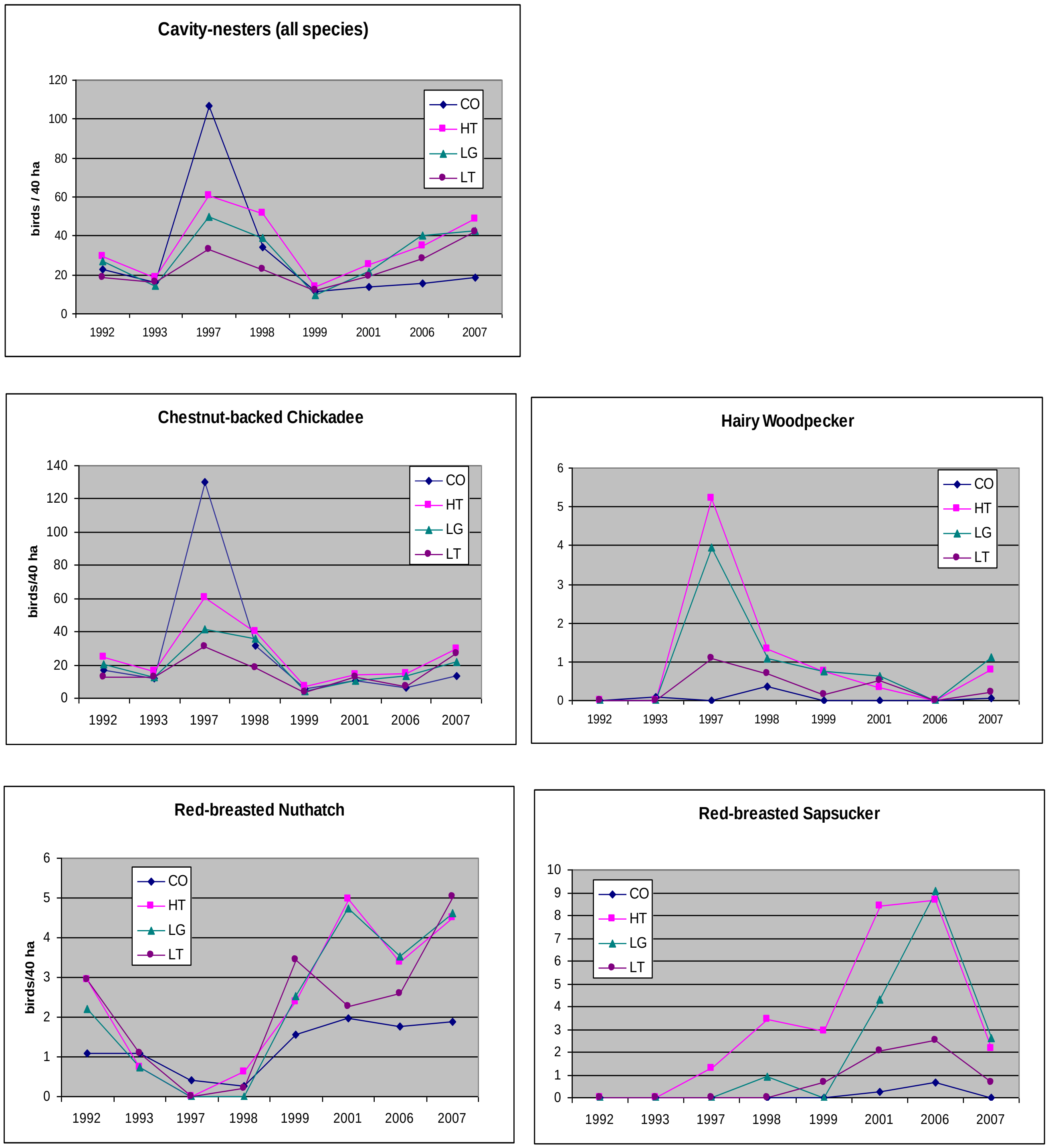
Discuss trade-offs of thinning and creating snags vs. leaving unthinnned for creation of snags through suppression mortality.

Discuss increases in abundance of some cavity-nesting birds in response to thinning (or mention in Intro.)

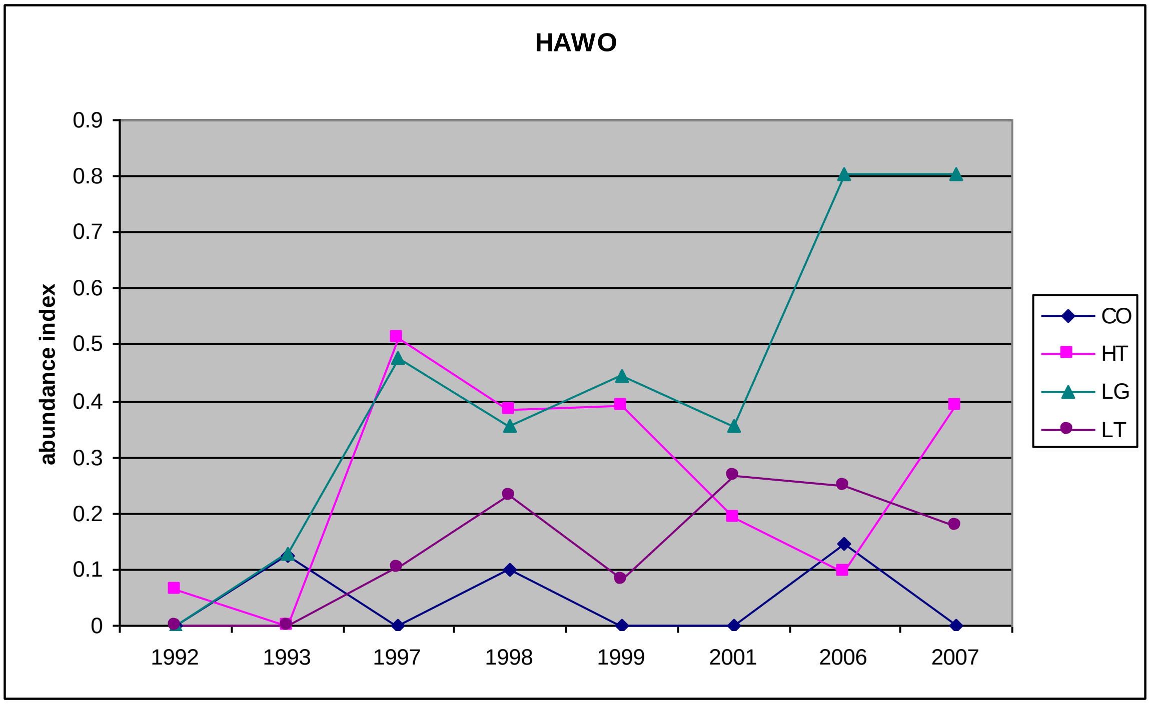
CONCLUSIONS

- Trees treated with saw-topping and saw-topping in combination with inoculation of heart-rot fungus **were used** for foraging and nesting by cavity-nesting birds.
- Trees treated with saw-topping in combination with inoculation more frequently supported bark beetles and pouch fungus, and were more frequently used for foraging by birds than trees treated with saw-topping alone. However, inoculation may not be cost-effective in the long term unless the rot is infiltrating throughout the stem rather than just creating short “stove-pipes” (B. Shreiber, pers. comm.).
- Snags created from trees < 20” diameter likely provide only marginal nesting habitat for most cavity-nesting birds, but may be important in providing cover for small mammals and winter roosting habitat for birds.

Figure 2. Trends in density (birds/40 ha) over 15 years for all cavity-nesting species combined, and for each of the four most common cavity-nesting species in the Young Stand Thinning & Diversity Study, Willamette N.F. 1992 and 1993 were prior to thinning treatment. Wildlife trees were created in 2001. Years between those labeled on x-axis were not sampled. Data is missing for the Hairy woodpecker in 2006.



Abundance index for hairy woodpecker.



Extra Text

We calculated an abundance index (birds/station/visit) for three species that occurred in at least 40% of the stand*year sampling units, but at densities too low to calculate reliably (Red-breasted Sapsucker, Hairy Woodpecker, and Townsend’s Solitaire). The Red-breasted Sapsucker was more abundant in LG and HT treatments than in LT and Control (Fig. 6). We did not detect a difference in the abundance of Townsend’s Solitaire and Hairy Woodpecker among treatments.