Cavity-Nesting Bird Activity in the YSTDS Stands, Spring 2010

Young Stand Thinning & Diversity Study (YSTDS)
Willamette National Forest, Oregon

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This report covers efforts to find active nests of cavity-nesting birds (woodpeckers, nuthatches, chickadees, etc) on the YSTDS stands from May to July 2010, and compare activity among the YSTDS treatments. Woodpeckers in particular are considered keystone species in forest ecosystems, not only for their role in excavating cavities which are subsequently used by other bird species, but also because richness of woodpecker species has recently been found to correlate with overall diversity and abundance of forest birds at local and larger spatial scales in both Europe and North America (Mikusinski et al. 2001, Virkkala 2006, Drever et al 2008, Drever and Martin 2010).

Background on the YSTDS and Snag Creation

Details concerning design and establishment of the Young Stand Thinning & Diversity Study (YSTDS) can be found at: http://andrewsforest.oregonstate.edu/research/related/ccem/yst/ystd.html.

The thinning treatments for this study were installed in 1995-97. Several years later (Sept-Dec 2001), a total of 720 snags were created in the same 16 treatment units (TACs). Target density of all snags (created plus natural) was 1 snag per acre. Two methods were used to kill Douglas-firs (*Pseudotsuga menziesii*) with dbh > 12”. Half of the trees were topped with a chainsaw at a height of about 50 feet, and the others were topped in the same way but also had plugs of fungal inoculant (pathogenic heartrot fungus *Fomitopsis pinicola*) installed high on the remaining bole. Saw cuts were "rough cut" to promote rapid decay from the top down. Two plugs of inoculant were placed in each inoculated tree. Trees were killed in pairs of similar size and in close proximity, with one member of each pair receiving each killing treatment. Pairs were scattered across each of the 16 TACs. Each snag was marked with a numbered metal tag.

In 2006 and 2008, Barry Schreiber surveyed a subset of these stands (TACs 8,10,12,15 and 16; no control stands) to determine whether cavity-nesting birds (CNBs) were using the created snags for foraging and/or nesting (Schreiber 2008). He found that nearly 21% of the surveyed snags had live tops; that is, the trees had not died. This appears to be a biased estimate due to sampling only a subset of the TACs. In surveying the condition of all snags in all TACs in 2009, I found that only 10% of the created snags still had live tops. It seems unlikely that half of those found with live tops by Schreiber in 2008, 7 years after topping, had died within one year. Schreiber also found that the proportion of created snags with some amount of cavity creation by birds increased from 9% in 2006 to 55% in 2008. Finally, in 2008, Schreiber found 2 active bird nests in created snag cavities, representing about 0.9% of snags surveyed; he also found 3 nests in natural snags and stumps. His report makes no mention of nests found in 2006, and it is not clear that he surveyed for nests that year.

After incidental sightings of active hairy woodpecker and chickadee nests in YSTDS created snags during the spring of 2009, it was decided to try again to gather enough data on CNB nesting activity to allow a comparison of the YSTDS thinning treatments and their effect on CNB habitat, as well as to determine the degree of use of the created snags by CNBs.

Methods

I adapted the protocol detailed in Dudley and Saab (2003). This adaptation is included as an appendix below, so I will not repeat details here. Also included as appendices are my nest card and timesheet designs.

Three protocol changes were adopted as the field season unfolded:

1. In the second round, instead of following the same transect routes through each stand, I tried to concentrate on areas not covered well in the first round. This was done to maximize the chance of finding nests. This is not meant to imply that the 2 surveys in each stand were exclusive; there was much spatial overlap between the 2 rounds.

2. After the first 2 days of surveys and in consultation with Joan Hagar, the time between playbacks was increased from 20 minutes to 30 minutes. This was done to increase the amount of time spent actively moving through the stand, to maximize chances of finding nests. During the second round, the number of playbacks were further decreased to 3 per 3-hour survey (1 at the beginning, 1 at the midpoint, and 1 in the last 20 minutes), because of my perception that playbacks were not succeeding as a means of locating nesting birds, especially as the season progressed into the incubation and nestling stages.

3. Finally, in an effort to maximize time spent looking for nests, nest cards were completed in the afternoon after surveys were finished. That is, when a nest was found, the location was carefully marked with a GPS, but no other data were recorded during the morning survey. Instead, I came back to the nest after surveys were finished for the day to make those measurements (nest height, orientation, etc) and fill out the nest cards.

Results

Two complete rounds of surveys were completed. Dates for the 2 rounds were May 17-June 8, and June 13-25. Because of an unusually rainy spring in 2010, and thus many days when surveys could not be accomplished, there was not enough time to complete a third round, so surveys were stopped after two rounds. Other factors considered in this decision were the declining rate of new nest discovery by late June (only 5 nests were found in the entire 2^{nd} round), and the advanced stage of phenology for most nests found (65% were actively feeding young when first discovered).

Total search time (all four replicates) per treatment type averaged 21.4 hours, and ranged from 20.5 hrs in Light Thin stands to 22.3 hrs in Heavy Thin stands. The difference is largely attributable to the time spent chasing down birds and recording nest data in the treatments with higher nest densities.

In all, 20 active nests of cavity-nesting species were found (Table 1). These included 11 nests of red-breasted nuthatches (*Sitta canadensis*), 7 nests of red-breasted sapsuckers (*Sphyrapicus ruber*), 1 of chestnut-backed chickadee (*Poecile rufescens*) and 1 of hairy woodpecker (*Picoides villosus*).

I found 7 nests in Gaps stands, 6 nests in Heavy Thin stands, 4 nests in Light Thin stands, and 3 nests in Control stands. Figure 1 shows nests found per hour of search time. Nest density appears to be negatively correlated with tree density. Notwithstanding the apparent pattern in the data, analysis-of-variance indicates that the differences among treatments are not statistically significant ($P = 0.0982$). However, there is a significant block effect, with the Cougar Block having significantly fewer nests/hour searched than at Mill Creek and Christy Flat ($P = 0.0244$; Fig. 2).

Figure 1: Cavity nests found in YSTDS stands, by treatment, Spring 2010.

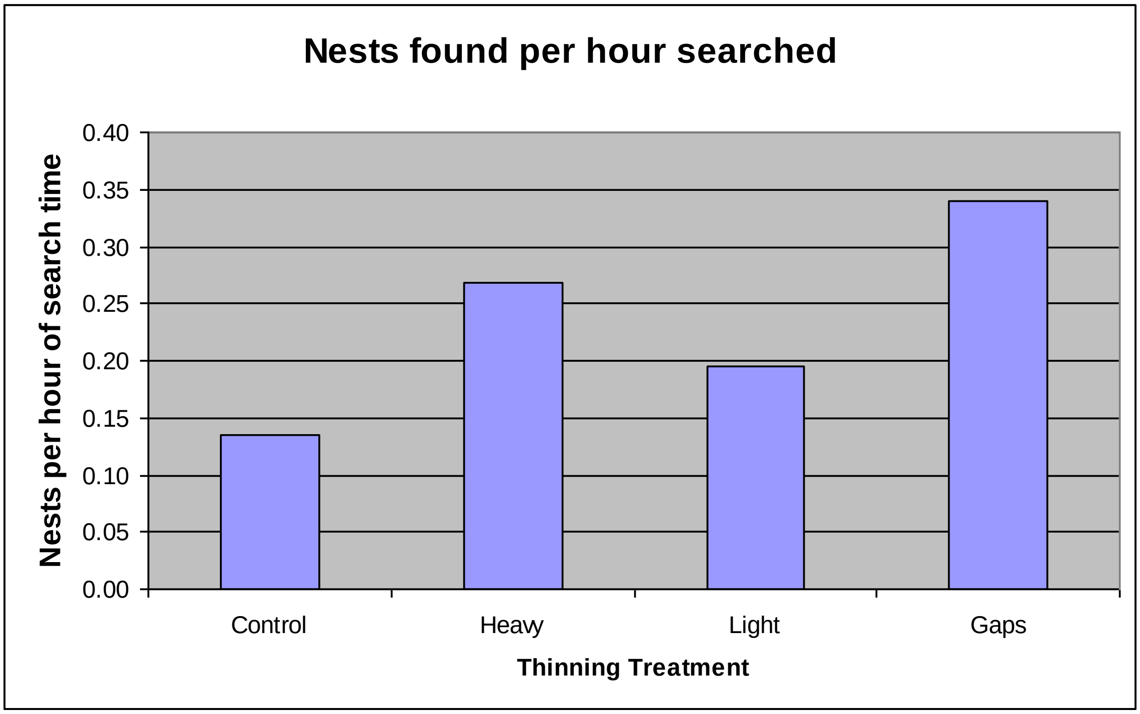
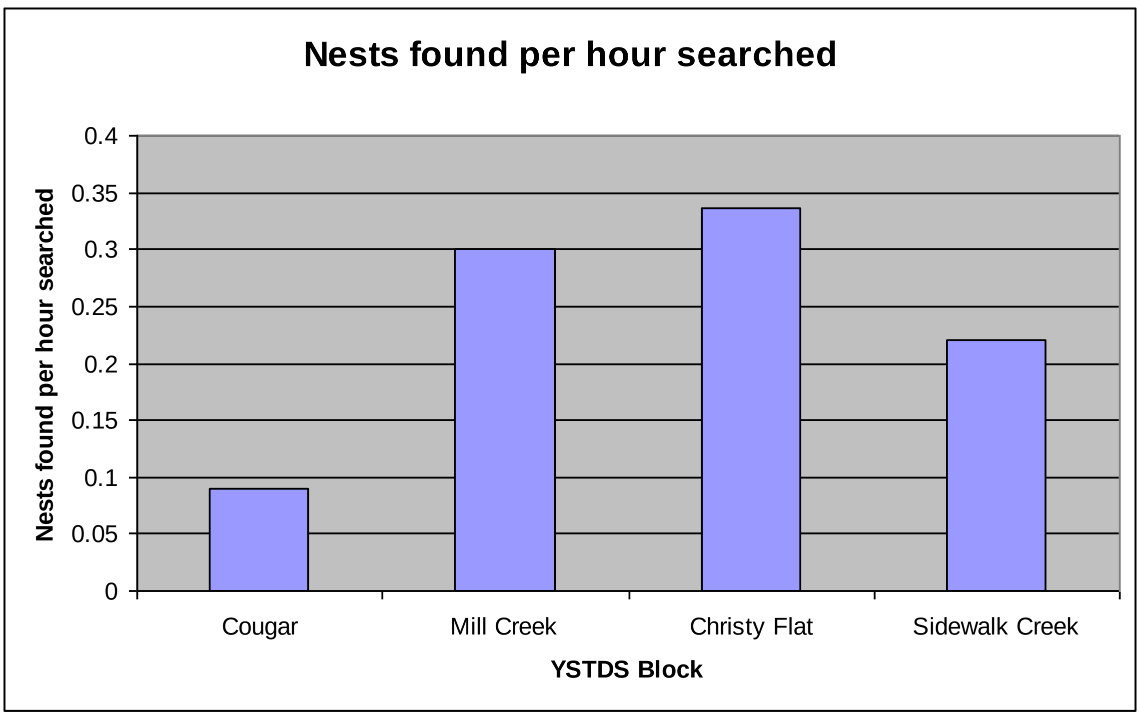


Figure 2: Cavity nests found in YSTDS stands, by Block, Spring 2010.



Nests were most frequently found in Douglas-fir (*Pseudotsuga menziesii*) snags created for the YSTDS by topping and inoculating trees in late 2001. Thirteen nests were in these artificial snags, 3 more were in natural Douglas-fir snags, 2 were in big-leaf maple (*Acer macrophyllum*) snags, and 1 each in cherry (*Prunus emarginata*) and madrone (*Arbutus menziesii*) snags. This bias towards artificial snags is not surprising given the paucity of natural snags in these stands.

Nuthatch nests were almost evenly split between artificial and natural snags (6 and 5, respectively), whereas sapsucker nests were most frequently in artificial snags. This is likely due to the fact that sapsuckers require relatively larger-diameter snags than do nuthatches, and the artificial snags were generally created from the largest trees left in the stands after thinning. One artificial snag contained active nests of both nuthatch and sapsucker.

Every nuthatch nest found was already at a late stage of development, with nestlings being fed. One nuthatch was actually fledging a few hours after I found it, and most nuthatch nests were inactive by the time I revisited them. Similarly, the single hairy woodpecker nest I found was nearly fledged when first found. Consequently, I was not able to pinpoint fledging dates or estimate nest initiation dates, and thus we have little to compare among stands or treatments, other than numbers of nests. For this reason, I think it would be good to start nest searches earlier than I did (May 17) in 2010, and perhaps start with the lower elevation stands first in order to find nests as early as possible in their development.

Because of the advanced development of many nestlings and the length of time between visits to each stand, it was impossible to know the success rate of nests. This was especially true for nuthatches.

Table 1: Characteristics of cavity nests found, Spring 2010.

Nest #	Bird Species	Treatment Area Code	YSTDS Treatment	Nest Ht m	Tree Species	Snag Type	Tree ht m	Tree dbh cm	Orientation Azimuth deg	Fate
1	Red-breasted Nuthatch	6	Heavy Thin	8.7	Bigleaf maple	Natural	13.1	25.8	150	Unknown
2	Hairy Woodpecker	7	Light Thin	14.3	Bigleaf maple	Natural	20.5	55	238	Successful
3	Red-breasted Sapsucker	7	Light Thin	14.1	Douglas-fir	Artificial	17.5	52	255	Likely failed
4	Red-breasted Nuthatch	5	Control	9.9	Douglas-fir	Natural	10.2	21	158	Unknown
5	Red-breasted Nuthatch	8	Gaps	18.2	Douglas-fir	Artificial	21.4	40	216	Unknown
6	Red-breasted Sapsucker	8	Gaps	16.8	Douglas-fir	Artificial	20.7	48	126	Failed
7	Red-breasted Nuthatch	12	Gaps	5.1	Madrone	Natural	6.9	39	64	Unknown
8	Red-breasted Sapsucker	10	Heavy Thin	14.8	Douglas-fir	Natural	17.2	46	230	Likely failed
9	Red-breasted Nuthatch	10	Heavy Thin	2.5	Douglas-fir	Natural	14.9	34	44	Unknown
10	Chestnut-backed Chickadee	10	Heavy Thin	22.9	Douglas-fir	Artificial	24.5	51.5	308	Likely failed
11	Red-breasted Nuthatch	13	Control	21.0	Douglas-fir	Artificial	21.2	47.5	55	Unknown
12	Red-breasted Sapsucker	15	Light Thin	15.0	Douglas-fir	Artificial	21.5	54	280	Likely failed
13	Red-breasted Nuthatch	16	Gaps	~15	Douglas-fir	Artificial	18.9	43.5	360	Unknown
14	Red-breasted Sapsucker	16	Gaps	14.1	Douglas-fir	Artificial	18.9	43.5	56	Unknown
15	Red-breasted Sapsucker	14	Heavy Thin	8.8	Douglas-fir	Artificial	17.5	39	75	Likely failed
16	Red-breasted Nuthatch	4	Gaps	15.4	Douglas-fir	Artificial	16.9	44	32	Unknown
17	Red-breasted Nuthatch	2	Heavy Thin	10.2	Douglas-fir	Artificial	21.7	45.5	130	Unknown
18	Red-breasted Nuthatch	11	Light Thin	4.9	Cherry	Natural	7.9	20	62	Successful
19	Red-breasted Sapsucker	12	Gaps	8.8	Douglas-fir	Artificial	12.6	54	16	Successful
20	Red-breasted Nuthatch	9	Control	13.2	Douglas-fir	Artificial	16.3	43	307	Unknown

No pattern was found in nest cavity orientation. Mean azimuth for all nests was 53º TN, and a test of Rayleigh's *z* statistic for angular dispersion showed that there was no significant departure from a random dispersion ($P > 0.5$). Mean azimuth for nuthatches alone was 71º TN, and the P value was between 0.2 and 0.5. Mean azimuth for sapsuckers was 19 º TN, with $P > 0.5$.

Two nest cavities were obviously enlarged after I found them, presumably by powerful nest predators (Figs 3 & 4, next 2 pages). One of these was a sapsucker nest, and the other a chestnut-backed chickadee nest.

Fig. 3: Sapsucker nest cavity enlarged, presumably by nest predator.

A: Nest as seen on 25 May 2010

B: Same nest, slightly different angle, on 18 June 2010.

Fig 4: Chestnut-backed chickadee nest cavity enlarged, presumably by nest predator.

A: Nest as seen on June 3, 2010. Cavity entrance is just below bird in flight, near top center. This was taken during excavation phase.

B: Same nest as seen on July 2, 2010.

Discussion

How to improve this protocol

I found disappointingly few (20) nest cavities in spring 2010. It's possible that poor weather may have prevented some birds from nesting successfully. The weather this spring was unusually cold and wet, and this does make it hard to survey (noise, wet binoculars, discomfort), but I suspect that some birds, particularly the larger woodpeckers, had already completed their nesting by the time I started surveying on May 17.

For example, the 2nd nest I found (on May 24) was a hairy woodpecker that was nearly fledged. Also, on my last day of surveying in TAC 14, I found what I believe to be a recently active hairy woodpecker nest. I had previously heard and tried to follow a hairy woodpecker in this TAC, but had not found the nest. I feel if I had done my 2nd survey earlier, I would have found this nest while it was still active. There were many other instances where I saw typical woodpecker nest cavities that looked very recently excavated, but with no current activity. Granted, some birds construct more cavities than they use, but I can't help thinking that I missed some early activity. And certainly the fact that all my nuthatch nests were well along in the feeding stage when first found suggests I missed some of those nests. In order to increase the rate of nest discovery, I would start surveying earlier in the year, and be a little less particular about working in light rain.

Another problem is that with the current protocol and the distance between the McKenzie blocks (1 & 2) and Oakridge blocks (3 & 4), I was not able to re-visit nests frequently enough to follow their development adequately to make judgments about nest success. In other words, the long time between visits resulted in uncertainty about whether particular nests fledged or failed. This is particularly true for the nuthatch nests which were already at an advanced stage of development when I found them. If I were to do this again, I would make an even greater effort to re-visit nests as often as possible in the afternoons after regular surveys. To facilitate this, it would be very helpful to have one person survey the McKenzie area TACs and another concentrate on the Oakridge area.

Effect of the YSTDS Thinning Treatments on Cavity-Nesting Bird Breeding

The YSTDS thinning treatments do appear to have an influence on the number of cavity nesting birds attempting to breed in these stands, even though the data from this single sample did not exhibit a statistical difference among the treatments. I'd be willing to wager that another season of sampling, starting earlier and with more frequent follow-ups on nests found, would yield statistics more supportive of the hypothesis that thinning increases the number of active nest cavities, and perhaps even increase fledging rates.

Literature Cited

Drever, M.C., Aitken, K.E.H., Norris, A.R., and Martin, K. 2008. Woodpeckers as reliable indicators of bird richness, forest health, and harvest. Biological Conservation 141: 624-634.

Drever, M.C. and Martin, K. 2010. Response of woodpeckers to changes in forest health and harvest: implications for conservation of avian biodiversity. Forest Ecology and Management 259: 958-966.

Dudley, J., and Saab, V. 2003. A field protocol to monitor cavity-nesting birds. Research Paper RMRS-RP-44. Fort Collins, CO: USDA-Forest Service, Rocky Mountain Research Station. 16 pp.

Mikusinski, G., Gromadski, M., and Chylarecki, P. 2001. Woodpeckers as indicators of forest bird diversity. Conservation Biology 15: 208-217.

Schreiber, B. 2008. Wildlife use of created snags/live-topped trees on young thinned conifer snags on the Willamette National Forest. Unpublished report, 19 pp.

Virkkala, R. 2006. Why study woodpeckers? The significance of woodpeckers in forest ecosystems. Annales Zoologici Fennici 43: 82-85.

Appendix A:
Protocol for Cavity Nesting Bird Surveys, Young Stand Study, Spring 2010

Objective: To gather data to compare YSS treatments in terms of cavity-nesting bird (CNB) fitness, by measuring nesting use, and perhaps nesting success, if time permits. A second objective is to compare the frequency of nests in created vs. natural snags, in order to assess the value of created snags as nest sites. Species of interest include all primary cavity builders (woodpeckers), and all secondary cavity using species, including red-breasted nuthatches, chickadees, house wrens, saw-whet owls, and northern pygmy owls.

Scope: All 16 YSS TACs will be surveyed between May 15 and July 15. Each morning that weather permits, 2 TACs will be surveyed for a maximum of 3 hours each and each TAC will be surveyed at least twice during the season. An ideal week should consist of visits to all TACs of 2 blocks, but poor weather may necessitate some rearrangement of this ideal schedule.

Order and Timing of Surveys: Blocks will be visited in the order 1,2,3,4. This order will be repeated in the 2^{nd} round. The order of TACs visited within each block has been randomized in advance using the RANDOM function in an Excel spreadsheet. Order of visits will NOT be the same in the second round as in the first. Each morning of surveying will start 30 minutes after local sunrise time.

Response Variable and Standardization of Effort: The response variable in these studies will be the number of CNB pairs nesting within each YSS treatment. Because we cannot sample exhaustively, this comparative variable is an index to CNB fitness in the different treatments, not a complete census; thus, it is dependent on the amount of survey effort expended in each TAC, and we will attempt to standardize that effort in terms of both time spent and distance traveled searching for birds. In order to do so, we will attempt to follow about the same transect distance within each TAC, to measure that distance using the GPS tracking feature, and to standardize effort as nests found per kilometer of transect traveled. We will also try to measure the amount of time spent in search mode during each 3-hour survey, and standardize effort as nests found per unit time searched.

Transect Layout: Surveys will be conducted by walking along transects that sample a representative portion of each TAC. To save time on layout at the beginning of the season, transects walked will be primarily along YSS Mammal Trapping Transects, which are already marked and are very familiar to Tom Manning, the surveyor. Because the YSS TACs are relatively small and the mammal transects only 30 m apart, surveys will be conducted along every 3^{rd} transect line (thus, 90 m between transects), with adjustments to standardize the total transect length per TAC to about 1240 m. The exact routes have been determined in advance, and marked on TAC maps that the surveyor will carry in the field. Starting points and direction within each TAC will be alternated between surveys; that is, start at one end during first survey, and at the other end for 2^{nd} survey.

Surveying Procedure: Surveys will begin 30 minutes after sunrise. Surveys will be called off or delayed if rain or wind is loud enough to hamper audibility, or if heavy fog impedes visibility. At the start, the time will be noted on the fieldsheet, the GPS tracking feature will be activated, and a call-back will be played, with approximately 1 minute of calling for each of 9 species of interest (PIWO, NOFL, HAWO, RBSA, CBCH, HOWR, RBNU, NSOW, and PYOW). During the playback, the surveyor will watch and listen carefully for a response by any CNB species, and be prepared to give chase immediately. If a response occurs, time will be noted, playback ceased, and the bird chased. Any bird of interest will be followed until lost, until it moves more than 100 m beyond the study area boundary and is unlikely to return, or until a nest tree is found. If a nest is found, the position will be carefully marked with a GPS and a nestcard filled out completely (location description, whether tree is a created snag, height of cavity, azimuth of cavity, tree species and condition, size of opening, species of bird, stage of nesting estimated, notes concerning behavior and presence of mate or nestlings, photographs). In addition, any courtship behavior by non-nesting birds will be noted, and the location marked on a map, to facilitate finding a nest on the next visit. When finished with a bird, the surveyor will return to the transect where the chase began, note the time, and resume surveying. After 20 minutes of silent surveying, another playback will be attempted. If there is no response, silent transect surveying will continue for 20 minutes between playbacks. The survey will end when 3 hours have elapsed since the start time, or the entire transect distance has been traveled. If the 3-hour limit is reached while chasing a bird or recording a nest, that work will continue until finished, and then the surveyor will move on to the second TAC of the day, where this procedure will be repeated. No more than 2 TACs will be surveyed in a day.

Post-survey record keeping: After the days' surveys are completed, GPS waypoints and tracks and photographs will be downloaded to a laptop computer. Whenever possible, fieldsheets will be photocopied and the copies stored apart from the originals. Field copies of nestcards will be recopied with ink onto a permanent set of cards to be kept in the office, and updated as needed.

Adapting to seasonal changes in bird behavior: As the breeding season progresses, it may become less worthwhile to use this playback tactic, and more worthwhile to rely on silent listening/watching for birds along the transects. Decisions about changing tactics will be made based on conditions and observed behavior, and in consultation with the PI, Joan Hagar.

Revisiting: If time permits, once 2 survey rounds have been completed, previously-found nests will be revisited to gauge nesting success. Also, we will attempt to revisit previously-found nests in the afternoon after surveying is finished. Also, if rain or wind makes surveying unadvisable, time will be spent revisiting previously-found nests.

Appendix B: Nestcard (front and back) for Cavity Nesting Bird Surveys, Young Stand Study, Spring 2010 (Cavity-Nester Nest Card.xls)

Year 2010	Willamette NF Oregon		Species	1st Observer T.Manning	Cavity ID#
Trt	TAC		Tasks Completed GPS Fate	Dir BT to nest [9]	Dist BT to nest [10]
Cavity Location/Description [11]					
Nest Status [12]				UTM (NAD83) Wypt name Northing Easting	
Find Method [13] (circle one) PB F SS NBC L PY YB					
Database ID#			Nest Ht (m)	Cavity Age	Decay Class
Tree Species			Tree Ht (m)	DBH (cm)	Orientation (º)
Orig. Exc. [23]	OE Cert [24] SURE UNSURE		Tree Top Condition [25]	Previous Cavity Yr & ID# [26, 28]	Previous Cavity Species [27]
Aspect [29]	Deg Slope [30]		Slope Position [31]	Multiple Cavity Yr & ID# [32, 34]	Multiple Cavity Species [33]

Visit Date [35] DD	MM	#egg [36]	#Yng [37]	Beg-End Time [38]	Observations (parental behavior, nestling development, fate, etc.) [39]	Contents [40]	Stage [41]	Observer [42]

Nest Fate [43] (circle one): 1- Successful Failed due to: 2- Bear, 3-Corvid, 4-Squirrel, 5-Chipmunk, 6-Snake, 7-weather, 8-cavity destroyed, 9-unknown, 10-other ___________, 11- fate unknown

Initiation Date [45]		Success/Failure Notes [44]: record detailed information used to determine nest fate
Date Fated [46]		
# Fledged [47]	Fledge Conf [48] Sure Unsure	

Appendix C: Timesheet for Cavity Nesting Bird Surveys, Young Stand Study, Spring 2010 (Cavity-Nester Fieldsheet.xls)

Cavity-Nesting Bird Survey, Spring 2010
Young Stand Thinning & Diversity Study, Willamette NF, Oregon

Date: ______________ TAC: _____ Observer: T. Manning Weather:_______________ Wind: ____________
Month Day

GPS Tracking on? ___

Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________
Start: _________	Notes:	____________________
Stop: _________		____________________

Appendix D: A few more photos

Red-breasted nuthatch nest cavity in a small madrone snag, TAC 12.

Red-breasted nuthatch nest cavity in a small natural Douglas-fir snag, TAC 10.

Red-breasted nuthatch feeding young at nest cavity in a large artificial Douglas-fir snag, TAC 2.


Red-breasted nuthatch feeding young at nest cavity in a small natural cherry snag, TAC 11.


Red-breasted sapsucker feeding young at nest cavity in a large natural Douglas-fir snag, TAC 12.


Red-breasted sapsucker feeding young at nest cavity in a large natural Douglas-fir snag, TAC 12