Songbird Community Response to Thinning of Young Douglas-fir Stands in the Oregon Cascades - Second Year Post-treatment Results for the Willamette N.F. Young Stand Study

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INTRODUCTION

The Cascade Center for Ecosystem Management initiated the Young Stand Thinning and Diversity Study on the Willamette National Forest to investigate the effects of several management regimes of young stands on vegetation and wildlife. The overall objective of the wildlife portion of the study is to evaluate the influence of various thinning regimes on abundance and distribution of wildlife. Pre-treatment bird surveys were conducted during the spring of 1992 and 1993 (Hagar 1996); the first post-treatment bird survey was conducted in June 1997 and the second post-treatment survey was conducted in May - June, 1998.

METHODS

Design

Three silvicultural treatments and a control were replicated in each of 4 geographic blocks (1 block each in McKenzie and Blue River Ranger Districts, and 2 blocks in Oakridge Ranger District). Each of the 4 stands comprising a block was assigned a different treatment. Each District determined the stand boundaries and the assignment of treatments to the stands within their jurisdiction. Harvesting was done at different times for each District, but harvests were completed between January 1995 and September 1997. Piling of brush, and burning of slash were completed in all units by the fall of 1998. Management activities such as control of noxious weeds, manual release of seedlings, fertilization, pruning, and creation of snags are planned in some units through the year 2003.

Bird Surveys

We sampled birds in each stand at point count stations that had been established during the first post-treatment bird survey in 1997. A single observer (J. Hagar) surveyed birds at the point count stations during 3 visits to each stand between 28 May and 30 June, 1998. The observer recorded the species of and distance to each bird detected during a 10 minute count period at each station. Surveys were conducted between _ hour before and 4 hours after sunrise. Surveys were not conducted during periods of heavy rain or strong wind because bird activity is suppressed and the observer's ability to detect birds is reduced under these conditions.

Data Analysis

Response variables included the community-level descriptors species richness and total abundance of all birds, as well as indices to abundance for selected species. An index to species richness was calculated from rarefaction curves (Ludwig and Reynolds

1988) for each stand in each year because sampling effort was unequal among stands and between years. Total abundance was calculated as the average number of observations/stand/visit for birds of all species observed within 50 m of the observer. In previous analyses I used 100 m as detection distance cutoff. While using a greater distance allows for the inclusion of more observations, and therefore can lead to greater statistical power in some cases, it also can lead to greater biases in the data. Estimations of distances between observer and birds is always difficult, but becomes very unreliable upwards of 50 m. Therefore, to minimize biases that result from double-counting individuals and including individuals that were actually outside of stand boundaries as members of the community, I reduced the cutoff distance for inclusion of observations in analysis to 50 m.

Individual bird species selected for analysis of treatment and year effects were those that were observed in > 12 of the 16 block-by-year combinations and in > 30% of the 64 stand-by-year combinations. An index to abundance of each species meeting these criteria was calculated as the number of times each species was observed within 50 m of observers, divided by the number count points-x-visits for each stand in each year.

ANOVA with Contrasts

For total abundance, species richness, and species that were observed in > 75% of the stand-by-year combinations, I used an ANOVA with orthogonal contrasts to test for effects of 1) treatment (all treatments combined vs. control), 2) thinning intensity (light vs. heavy thin), and 3) thinning pattern (evenly-spaced light thin vs. light thin with gaps). The contrasts were set up to compare the average difference in abundance between the treatments of interest before harvest (i.e., the baseline variability) with the average difference in abundance between the same treatments after harvest.

For species that were observed in 30-74% of the stand-by-year combinations, I used orthogonal contrasts of first order differences to assess the treatment effect on differences in abundance between pre- and post-treatment phases of the study. First order differences were calculated as average abundance in the post-treatment years minus average abundance in the pre-treatment years for each treatment.

RESULTS and DISCUSSION

The response of community-level parameters to thinning during the second season of post-treatment surveys was similar the results of the first post-treatment survey. Total abundance of birds remained unaffected by thinning in general (Table 1), and unresponsive to different intensities or patterns of thinning (Tables 2, 3). Unlike total abundance, species richness did increase in response to thinning. The marginal trend of an increase in species richness in response to thinning overall that was observed in the first post-treatment survey became statistically significant with the addition of the second season of post-treatment data. Species richness remained unresponsive to thinning intensity and pattern.

I detected a change in the abundance of 11 bird species in response to thinning (Tables 1 - 3). Not all of these responses were consistent with those observed during 1997, the first season of post-treatment surveys. Increases in the abundance of 3 species (dark-eyed juncos, Hammond's flycatchers, and western tanagers) were consistent with those observed in 1997. In addition, I was able to detect an increase in the abundance of gray jays in response to thinning in general, and an increase in the abundance of Steller's jays in response to thinning intensity (Table 2). The abundance of dark-eyed juncos was greater in heavily- than in lightly thinned stands, indicating a positive response to thinning intensity. In contrast, the response of Hammond's flycatchers appears to be positive only for the lightly thinned stands, because their abundance in the heavily thinned and gapped stands was significantly lower than in the light thinnings (Tables 2 and 3). This response was consistent for both post-treatment surveys.

Six species decreased in abundance in response to thinning. The decrease in abundance of Pacific-slope flycatchers and hermit thrushes in response to thinning overall was consistent with, but more significant than, their response in 1997. Furthermore, hermit thrush abundance decreased in heavily thinned compared to lightly thinned stands (Table 2). Similarly, as was observed in 1997, the abundance of winter wrens decreased in heavily thinned and gap treatments compared to lightly thinned stands. I was also able to detect a significant decrease in winter wren abundance in response to thinning in general in 1998 (Table 1) that I had been unable to detect in 1997. Three additional species (hermit warbler, golden-crowned kinglet, and Swainson's thrush) for which I was unable to detect a response with the 1997 data alone, showed a decrease in abundance with the added power of the 1998 data. Although hermit warbler and Swainson's thrush abundance decreased in response to thinning in general, I could detect no response to thinning intensity or pattern for these species. However, golden-crowned kinglets may respond negatively to thinning intensity (Table 2) but this response is inconclusive ($P = 0.10$) without more data.

Two species that appeared to decrease in abundance in response to thinning in 1997 (chestnut-backed chickadee and Hutton's vireo), did not show a similar response in 1998. Thus, the response of these species to thinning is inconclusive. It is possible that chestnut-backed chickadees and Hutton's vireos responded negatively immediately following thinning, but that they recovered by the second post-treatment survey. A third season of post-treatment data collection would be helpful in drawing conclusions about these species.

PROBLEMS ENCOUNTERED

In both 1997 and 1998 bird surveys were disrupted by management operations in or adjacent to the study stands during the bird breeding season. In 1997, tractors were raking slash in the treatment units at Christy Flats (Oak Ridge District) during one scheduled survey. The necessary postponement of this survey contributed to the inability to complete as many site visits as planned for the 1997 season. Furthermore, the mechanical activity in the stand likely disrupted the ground- and shrub-nesting birds, and will complicate interpretation of treatment effects. In 1998, harvesting operations in stands adjacent to the Christy Flats block made access to the study sites difficult and dangerous, interfered with the observer's ability to detect birds, and may have disrupted bird activity. During one visit, one point had to be omitted from the survey because the noise from nearby machinery was too loud to allow detection of birds, even if there were birds in the area that had not been displaced by the disturbance. Again, the postponement of surveys due to harvesting operations contributed to the inability to complete as many site visits as planned for the 1998 season.

PLANS FOR 1999

A third post-treatment bird survey is planned for May and June 1999. This survey will be essential to compensate for problems encountered during the first 2 seasons of post-treatment data collection (described above), and to conclude the initial post-treatment phase of this study of bird response to thinning. If surveys in 1999 are free of disruption from management activities, a relatively unbiased estimate of bird abundance can be made to confirm patterns observed to date. Furthermore, data on habitat structure that will be collected in 1999 by Gabe Tucker's vegetation crew can be used to model bird-habitat relations if data on birds is collected simultaneously.

LITERATURE CITED

Hagar, J. 1996. Pre-treatment analysis of wildlife-habitat relationships in young managed stands in the Oregon Cascade Range. Report prepared for USDA Forest Service, Willamette N.F. 35 pp.

Ludwig, J. A., and J. F. Reynolds. 1988. Statistical Ecology. John Wiley and Sons, New York. 337 pp. + diskette.

Table 1. Difference in total abundance, species richness[1], and mean abundance (average number of birds per station per visit) of common bird species, in control (unharvested) and treated (light thin, heavy thin, and thin-with-gaps) stands between pre-treatment (1992-1993) and post-treatment (1997-1998) periods, Willamette N.F., Oregon. P is the probability associated with the null hypothesis that the average difference is the same before and after application of treatments, repeated measures ANOVA with orthogonal contrasts.

	Difference (Treated – Control)		
	Pre-Treatment	**Post-Treatment**	P
Community Measures			
Total Abundance	0.30	0.60	0.961[2]
Species Richness	-0.60	1.50	0.034
Species with Positive Treatment Response			
Dark-eyed junco	0.00	0.70	<0.001[2]
Gray jay	-0.02	0.04	0.039[1]
Hammond’s flycatcher	0.00	0.79	<0.001[2]
Western tanager	0.00	0.23	0.088[2]
Species with Negative Treatment Response			
Golden-crowned kinglet	0.00	-0.30	0.008
Hermit thrush	0.09	-0.25	<0.001
Hermit warbler	0.20	-0.30	0.050
Pacific-slope flycatcher	-0.10	-0.40	0.005[2]
Swainson’s thrush	0.00	-0.30	0.060
Winter wren	0.00	-0.30	0.027[2]
Species with no response detected			
American robin	0.01	0.11	0.139[2]
Black-headed grosbeak	-0.04	0.03	0.136
Chestnut-backed chickadee	0.00	-0.10	0.231[2]
Evening grosbeak	0.02	0.10	0.339[2]
Hutton’s vireo	0.01	-0.01	0.710
Pine siskin	0.02	0.00	0.437
Red-breasted nuthatch	0.00	-0.01	0.546
Steller’s jay	0.00	0.00	0.181[2]
Varied thrush	-0.02	-0.11	0.193

[1] Species richness for pre-treatment phase was calculated as the average number of species per stand cross both years; for the post-treatment data, a species richness index was calculated from rarefraction curves (Ludwig and Reynolds 1988).
[2] Abundance index transformed with logarithmic function for analysis, means reported are untransformed.

Table 2. Effect of thinning intensity on total abundance, species richness[1], and mean abundance (average number of birds per station per visit) of common bird species in Willamette N.F., Oregon. P is the probability associated with the null hypothesis that the average difference between light (100 – 120 residual trees/acre) and heavy thin (50 reidual trees/acre) stands, is the same before and after application of treatments, repeated measures ANOVA with orthogonal contrasts.

	Difference (Heavy – Light)		P
	Pre-Treatment	**Post-Treatment**	
Community Measures			
Total Abundance	-0.20	-1.50	0.17
Species Richness	-0.80	0.90	0.19
Species with positive response			
Dark-eyed junco	0.00	0.04	0.04[2]
Steller's jay	0.00	0.10	0.02[2]
Species with negative response			
Golden-crowned kinglet	0.10	-0.20	0.10
Hammond's flycatcher	-0.06	-1.03	<0.01
Hermit thrush	0.14	-0.01	0.09
Winter wren	0.00	-0.70	<0.01[2]
Species with no response detected			
American robin	-0.01	0.07	0.31[2]
Black-headed grosbeak	-0.01	-0.05	0.50
Chestnut-backed chickadee	0.20	0.40	0.61[2]
Evening grosbeak	-0.03	-0.02	0.95
Gray jay	0.00	0.03	0.59[2]
Hermit warbler	-0.10	-0.30	0.40
Hutton's vireo	0.01	0.01	0.91
Pacific-slope flycatcher	-0.10	-0.20	0.76[2]
Pine siskin	0.00	0.01	0.67
Red-breasted nuthatch	-0.02	0.03	0.21
Swainson's thrush	0.10	0.00	0.56
Varied thrush	0.02	-0.02	0.60
Western tanager	-0.03	-0.07	0.91

Table 3. Effect of thinning pattern on total abundance, species richness[1], and mean abundance (average number of birds per station per visit) of common bird species in Willamette N.F., Oregon. P is the probability associated with the null hypothesis that the average difference between stands treated with light (100 – 120 residual trees/acre) and light-with-gap (50 reidual trees/acre) thinning, is the same before and after application of treatments, repeated measures ANOVA with orthogonal contrasts.

	Difference (Gapped – Light)		
	Pre-Treatment	**Post-Treatment**	P
Community Measures			
Total Abundance	-0.20	-1.10	0.500[2]
Species Richness	-0.50	1.00	0.224
Species with positive response			
Dark-eyed junco	-0.10	0.20	0.077[2]
Species with negative response			
Hammond’s flycatcher	-0.05	-0.46	0.080[2]
Winter wren	0.10	-0.60	0.004[2]
Species with no response detected			
American robin	-0.01	0.08	0.252[2]
Black-headed grosbeak	-0.01	-0.03	0.644
Chestnut-backed chickadee	0.20	0.20	0.940[2]
Evening grosbeak	0.02	0.09	0.501[2]
Golden-crowned kinglet	0.00	-0.20	0.228
Gray jay	0.00	0.01	0.829[2]
Hermit thrush	-0.02	0.00	0.796
Hermit warbler	0.00	-0.10	0.824
Hutton’s vireo	0.01	-0.02	0.538
Pacific-slope flycatcher	-0.10	-0.10	0.704[2]
Pine siskin	0.01	0.01	0.899
Red-breasted nuthatch	-0.04	-0.01	0.367
Steller’s jay	0.00	0.00	0.567[2]
Swainson’s thrush	0.00	-0.10	0.359
Varied thrush	0.08	0.03	0.432
Western tanager	-0.04	-0.03	0.989[2]