Songbird Community Response to Thinning of Young Douglas-fir Stands in the Oregon Cascades - Third Year Post-treatment Results for the Willamette N.F., Young Stand Thinning and Diversity 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); post-treatment bird surveys have been conducted in May - June 1997 through 1999. Post-treatment sampling is planned for 2001, and periodically thereafter.

METHODS

Design

Four silvicultural treatments (light thinning, heavy thinning, light thinning with canopy gaps, and 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 using standard point count methodology (Ralph et al. 1995) at stations that had been established in each stand during the first post-treatment bird survey in 1997. Matt Hunter conducted the pre-treatment bird surveys in 1992-1993. Post-treatment surveys were conducted by Shay Howlin in 1997, Joan Hagar in 1998, and Roy Gerig in 1999. Birds were surveyed at the point count stations during 3 visits to each stand from 16 May to 24 June in 1997, from 28 May to 30 June in1998, and during 4 visits from 2 June to 15 July in 1999. Observers recorded the species of and distance to each bird detected during a 10-minute count period at each station. Surveys were conducted between 1/2 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 Shannon's diversity index, as well as estimates of breeding density (birds/40 ha) for 21 bird species. Breeding densities were calculated for species that were present in at least 12 of the stands (n=16) and in at least 32 of the stand by year combinations (n=80). We also assessed treatment effects for cavity nesters as a group and for neotropical migrants as a group. Species included in the cavity-nesting group were black-capped chickadee, chestnut-backed chickadee, red-breasted nuthatch, brown creeper, house wren, red-breasted sapsucker, downy woodpecker, hairy woodpecker, northern flicker, and pileated woodpecker. Species included in the neotropical migrant group were common nighthawk, rufous hummingbird, black-throated gray warbler, western wood-pewee, Pacific-slope flycatcher, Hammond's flycatcher, Swainson's thrush, hermit thrush, warbling vireo, hermit warbler, MacGillivray's warbler, Wilson's warbler, western tanager, and black-headed grosbeak.

We defined bird density for each stand as the number of birds detected over the effective area surveyed. We estimated the effective area surveyed for every point count and species based on a detectability model for the species and levels of covariates at the time of the survey. We adjusted the effective area surveyed for every bird observation to average detectability conditions (Beavers and Ramsey, 1998). We used the detectability model for each species to estimate the effective area for every point count incorporating the level of the covariates at the time of the

survey. (Beavers and Ramsey, 1998). Three factors were assumed to influence the effective area surveyed: the observer, number of minutes past sunrise, and tree density. Seven detectability models were fit, three univariate (single factor) models, three two-factor models, and the three-factor model. We used Akaike's information criterion (AIC) to select the best model for each species (Burnham and Anderson 1998).

We used Poisson regression of bird density to estimate a parameter representing the difference between average bird density before and after thinning. This parameter effectively summarizes the time dimension of the study for each stand. Sixteen parameter estimates (one for each stand) were modeled using normal regression to determine the influence of thinning treatment and study area on the log of the ratio of pre- to post-treatment densities. Each model contained an intercept, three treatment indicator variables and three site indicator variables. The treatment and site variables were tested for significance using an approximate F test. The parameter estimates for the treatment variables are indications of the influence of thinning on the log of the before- to- after ratio of density as compared to the control treatment. We did this analysis for 21 species, cavity-nesters, neotropical migrants, species richness, and diversity. We used SAS statistical software for all analyses (SAS Institute 1990).

RESULTS and DISCUSSION

Bird species richness and diversity increased in all 3 thinning treatments relative to controls (Table 1). Four species showed evidence ($\underline{P} < 0.10$) of an increase in density in response to at least 1 thinning treatment. Of these species, Hammond's flycatcher and dark-eyed junco also have been documented as responding positively to thinning in the Oregon Coast Ranges (Hagar et al. 1996, Hayes and Weikel, unpublished data). Density of MacGillivray's warblers and western tanagers increased in heavily thinned and gapped treatments, but not in the lightly thinned treatment.

The frequency of detection of 5 additional species increased in thinned stands (Table 2). Although these species were observed too infrequently to permit statistical analyses, we believe that their occurrence in at least 2 post-treatment years, usually in several blocks, and only in treated stands during the post-treatment phase, compared to their rarity during the pre-treatment phase of the study, provides evidence of a positive response to thinning treatments. Increases in the abundance of one of these species, the Townsend's solitaire, have also been observed by Hayes and Weikel (unpublished data) following thinning in the Tillamook State Forest. Another of the 5

species that was detected more frequently following thinning, the olive-sided flycatcher, is on the Oregon State Sensitive Species List (Oregon Natural Heritage Program 1998). Olive-sided flycatchers typically inhabit edges between old- and young-growth forests where they forage for aerial insects from a high perch. Thinning in young stands may create the uneven canopy structure that facilitates this foraging strategy. Western wood-pewees also forage on aerial insects, and similarly may have increased in response to canopy gaps created by thinning. The increase in the frequency of detection of red-breasted sapsuckers following thinning may have been related to the attraction of this species to trees wounded during the thinning operation. Finally, brown-headed cowbirds were observed on several occasions in one stand that was within a few miles of pasture. Openings in the forest resulting from thinning and associated skid trails may facilitate invasion by brown-headed cowbirds into forested areas. Brown-headed cowbirds are brood parasites, laying their eggs in the nests of other birds, usually to the detriment of the host's nestlings. Therefore, bird species that are susceptible to parasitization by cowbirds (e.g., thrushes and warblers that build open cup nests) may suffer decreased productivity rates in thinned stands bordering pasture and farmland.

Six species decreased in density in response to thinning (Table 1). All of these species, except the hermit thrush, were common on all our study sites, and are among the most common breeding birds in the study region (Gilbert and Allwine 1991; Huff and Raley 1991). Therefore, although these species may decrease in density following thinning, their populations are likely to persist. Furthermore, Pacific-slope flycatchers, winter wrens, and golden-crowned kinglets have been associated with old-growth forests (FEMAT 1993; Gilbert and Allwine 1991). Because thinned stands are expected to achieve old-growth structure sooner than unthinned stands (Bailey et al. 1998; Bailey and Tappeiner 1998), thinning is likely to benefit these species over the long term.

Only one species, the American goldfinch, was observed consistently and exclusively during the pre-treatment phase of the study. However, it seems unlikely that the decrease in detections of goldfinches during the post-treatment phase was related to the treatments themselves. American goldfinches typically inhabit old fields and young clearcuts, where they feed on the seeds of thistles and other herbaceous vegetation. The observations of this species during the pre-treatment phase may have been of birds flying above the forest canopy; observers during the post-treatment phase assigned a special distance code to birds flying overhead, so that they could be excluded from analyses.

Table 1. Estimates of bird species richness, Shannon Diversity, and density (birds/40 ha) by species and species groups in 3 thinning treatments, Willamette N.F., 1992-1999. P-values represent the probability associated with the null hypothesis of no treatment effect (BACI analysis). Species are listed in taxonomic order within response group.

	Heavy		Light with Gaps		Light	
Species	Estimate	P	Estimate	P	Estimate	P
Positive Response to Thinning						
Species Richness	0.313	0.010	0.256	0.026	0.219	0.049
Shannon Diversity	0.178	<0.001	0.143	0.001	0.072	0.045
Hammond's flycatcher	21.937	0.075	15.997	0.180	9.492	0.415
MacGillivray's warbler	23.751	0.010	23.065	0.012	9.205	0.262
Western tanager	14.397	0.102	14.509	0.099	7.748	0.359
Dark-eyed junco	2.022	0.008	2.522	0.002	1.378	0.050
Negative Response						
Pacific-slope flycatcher	-0.667	0.313	-0.886	0.186	-1.143	0.096
Winter wren	-0.875	0.072	-1.00	0.042	-0.192	0.673
Golden-crowned kinglet	-1.626	0.003	-1.607	0.003	-0.980	0.047
Swainson's thrush	-0.444	0.230	-0.759	0.051	-0.901	0.025
Hermit thrush	-2.285	0.001	-2.462	<0.001	-2.177	0.001
Hermit warbler	-0.498	0.011	-0.342	0.061	-0.278	0.119
No Response Detected						
Cavity nesters[1]	-0.307	0.431	-0.202	0.601	-0.388	0.323
Gray jay	16.231	0.130	15.352	0.151	14.846	0.163
Steller's jay	7.358	0.294	6.620	0.343	0.163	0.981
Chestnut-backed chickadee	-0.907	0.166	-0.578	0.366	-0.998	0.131
Red-breasted nuthatch	-6.301	0.458	-12.765	0.146	-0.107	0.990
Varied thrush	-20.033	0.182	-13.208	0.369	-6.703	0.644
Hutton's vireo	-7.516	0.289	-1.305	0.850	-8.202	0.249
American robin	1.512	0.912	8.690	0.529	8.706	0.528
Neotropical migrants[2]	0.016	0.896	0.133	0.299	0.003	0.980
Black-throated gray warbler	11.822	0.247	4.974	0.618	12.359	0.227
Black-headed grosbeak	6.573	0.371	6.200	0.371	-0.400	0.953
Red crossbill	1.311	0.852	-5.543	0.435	-6.508	0.362
Evening grosbeak	-5.218	0.458	1.216	0.861	-5.277	0.453

[1] Cavity nesting birds = black-capped chickadee, chestnut-backed chickadee, red-breasted nuthatch, brown creeper, house wren, red-breasted sapsucker, downy woodpecker, hairy woodpecker, northern flicker, and pileated woodpecker.

[2] Neotropical migrants = common nighthawk, rufous hummingbird, black-throated gray warbler, western wood-pewee, Pacific-slope flycatcher, Hammond's flycatcher, Swainson's thrush, hermit thrush, warbling vireo, hermit warbler, MacGillivray's warbler, Wilson's warbler, western tanager, and black-headed grosbeak.

Table 2. Uncommon bird species that differed in detection rate before and after application of thinning treatments in young Douglas-fir stands, Willamette N.F., Oregon. Species shown were observed within 100 m of observers ≥5 times during one phase (pre- or post-treatment) and ≤1 time during the other phase.

Species	Number Observed		Years Observed	Blocks[1]	Treatments
	Pre-trt.	Post-trt.			
Most observed pre-trt.					
American goldfinch	17	0	1992, 1993	CF, CR, ML, SC	Light, Heavy, Light with Gaps
Most observed post-trt.					
Red-breasted sapsucker	0	9	1997, 1998, 1999	CF, CR, ML, SC	Light, Heavy
Western wood-pewee	1	9	1997, 1999	CF, ML, SC	Light, Heavy, Light with Gaps
Olive-sided flycatcher	0	11	1997, 1999	CR, ML, SC	Light, Heavy, Light with Gaps
Townsend's solitaire	0	33	1997, 1998, 1999	CF, CR, ML, SC	Light, Heavy, Light with Gaps
Brown-headed cowbird	1	14	1997, 1998	ML	Light

[1] Blocks in which species was observed. CF = Christy Flats, Oakridge District; CR = Cougar Reservoir, Blue River District; ML = Mill Creek, McKenzie Bridge District; SC = Sidewalk Creek, Oakridge District.

PLANS FOR 2001

We are preparing a manuscript for submission to Forest Ecology and Management or Ecological Applications that will report on the response of diurnal songbirds to thinning treatments through the first 3 years of post-treatment data collection.

A fourth post-treatment bird survey is planned for May and June 2001. Data on habitat structure that will be collected simultaneously can be used to model bird-habitat relations.

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