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Summary of Bird Survey and Banding Results at W.L. Finley National Wildlife Refuge, 1998–2008

By Joan Hagar

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Photograph on title page is a Common Yellowthroat at Finley National Wildlife Refuge, Oregon by Joe Staff.

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Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot (ft)
hectare (ha)	2.471	acre (acre)

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Introduction

With some of the best remaining examples of oak habitats in the Willamette Valley, the Willamette Valley National Wildlife Refuge Complex (WVNWRC) has been implementing restoration efforts to reverse the successional trend towards Douglas-fir and maple that is threatening existing oak woodlands. The restoration work has been considered a model for other public and private efforts within the Willamette Valley, and has been showcased through the Oregon Oak Communities Working Group (www.oregonoaks.org). Although many oak restoration projects have been initiated over the last several years, and grant recipients typically identify wildlife species that are likely to benefit from their project, measures of success have not included the actual response of wildlife, such as a change in the probability of species occurrence or abundance. Monitoring in the WVNWRC has so far been limited to vegetative and structural changes within the plant community.

Hagar and Stern (2001) identified bird species occurring in Willamette Valley oak woodlands that might be expected to benefit from such restoration efforts, including an endemic subspecies of the White-breasted Nuthatch (see Appendix 1 for scientific names of bird and plant species listed in this document), and the Acorn Woodpecker, both of which are species of concern in Oregon. However, empirical data documenting responses of bird assemblages to restoration actions are needed. The goal of this study was to document the effects of a restoration project in an Oregon White Oak woodland on Pigeon Butte in the W.L. Finley National Wildlife Refuge. Restoration treatments on Pigeon Butte include the removal of shade-tolerant tree species (primarily big-leaf maple and Douglas-fir) to reduce competition with oak trees and to return the stand to a more open structure. The objectives of this ongoing study are to compare abundance, survival, and productivity of diurnal songbird species before and after application of these restoration treatments. Monitoring these vital rates will provide crucial information about the effects of management on survival and productivity (DeSante and Rosenberg, 1998). Therefore, a constant-effort mist-netting project was continued in 2007 and 2008 that had previously collected songbird demographic data at Pigeon Butte from 1998 to 2002. Point-count surveys were conducted in the woodland to build on historical data available for the site (Anderson, 1970; Hagar and Stern, 2001). The data reported here represent 5 years of point count surveys and 6 years of banding before restoration treatment, but only one post-treatment sampling season. Continued monitoring of the bird population is recommended to determine both short-term effects and long-term trends following the habitat alterations that result from restoration treatment.

Methods

Study Site

William L. Finley National Wildlife Refuge lies at the base of the foothills of the Coast Range on the western edge of the central Willamette Valley, Oregon. Pigeon Butte is located at the highest point on the refuge, and is covered by a dense woodland dominated by Oregon White Oak. Bigleaf Maple and Douglas-fir also were common trees in the woodland. Common understory shrubs included Snowberry, Poison Oak, Hazel, Indian Plum, Trailing Blackberry, and Swordfern. The restoration was applied to approximately 4 ha in the southeastern corner of the 28-ha oak woodland on Pigeon Butte in the fall of 2007. The restoration treatment consisted of mechanical removal of maple and other non-oak trees, followed by herbicide applications to stumps, mowing, and seeding native grasses and forbes.

MAPS Banding and Breeding Status Determination

I followed protocols established by the Institute for Bird Populations (IBP) for operation of Monitoring Avian Productivity and Survivorship (MAPS) Program stations (Institute for Bird Populations, 2001). I captured birds on 8 days between May 21 and August 10 in each year. I used twelve 12.0 × 2.6 m, 30 mm mesh mist nets spaced throughout the eastern one-third of the stand to capture birds. Nets were set up at dawn and checked at least every 50 minutes for approximately 6 hours. I recorded the species, sex, and age of each bird captured using guidelines described in Pyle (1997). All species except hummingbirds were banded with a USGS-issued metal band with a unique number. In addition, all bird species observed at the site were recorded and their activity noted according to standard protocol established by IBP (Institute for Bird Populations, 2001). I used this information to determine the breeding status of all birds observed. All capture data and breeding bird species lists were submitted to the IBP to contribute to their regional and continent-wide bird population monitoring programs.

To evaluate trends in capture rates of birds across years, I calculated the number of individuals captured for each species in each season by summing the number of unique individuals (excluding within-season recaptures) that were captured across the 8 sample days, and dividing by total net hours (1 net hour = one 12-m net operated for 1 hour). Because Rufous Hummingbirds were not banded, I could not keep track of unique individuals; therefore, I used the total number of captures of hummingbirds to calculate capture rates for this species. All capture rates are reported as birds per 100 net hours.

Point Counts

I conducted point count surveys on four dates between June 2 and June 26, 2008. Point counts were conducted at five stations originally established by Hagar and Stern in 1994 (Hagar and Stern, 2001) and subsequently surveyed in 1995, 1996, 2004, and 2007. At each station, I recorded all birds observed within a 10-min count period, and estimated the distance to each bird. All surveys were conducted within 4 hours of sunrise on days without rain or wind.

I combined point count data from all 6 years of surveys to evaluate changes in the songbird community over time. I grouped the survey years into three phases: (1) 1994–96 comprised the “Baseline” survey phase, and represented the bird assemblage in an unmanaged, closed-canopy oak woodland; (2) 2004 and 2007 comprised the “Pre-treatment” survey phase, and also represented the bird assemblage in an unmanaged, closed-canopy oak woodland, but a decade after the first phase, and 1–4 years before implementation of restoration treatment; (3) 2008 represents the first breeding season after restoration treatment.

I calculated an index to abundance for commonly occurring species and all species combined (total abundance) by averaging the number of observations per point count station per visit within each year. I used analysis of variance (ANOVA) (Proc GLM in SAS ver. 9.2) to compare abundance indices among the three phases of the study for total abundance and 13 species that were observed in at least 40 percent of the sample units (one sample unit was defined as one visit to one station within a year). Species that occurred less frequently were not amenable to ANOVA analysis because of the large number of null observations.

Results and Discussion

Mist-Netting

A cumulative total of 1,193 birds captured over 7 years of mist-netting (1998–2002, 2007–08) represented 38 species. Many of these species experience high background levels of annual variation in population size. In addition, the response of some species to the initial disturbance caused by restoration activities may not accurately indicate longer term responses to resulting habitat changes. Therefore, multiple years of post-treatment data are needed to confirm responses of each species to restoration treatment. Furthermore, the results reported here represent data collected at a single restoration site. Replicated research in woodlands throughout the region is needed to confirm and better understand the mechanisms underlying the responses of all species to restoration treatments. For these reasons, the initial results reported below do not represent conclusive responses to restoration treatment for any species.

The capture rate of 14 species increased in 2008 after restoration treatment, relative to their 6-year pre-treatment average capture rates (table 1). Four of these species (White-breasted Nuthatch, Cedar waxwing, Western Wood-pewee, and Lazuli Bunting) were among those identified by Hagar and Stern (2001) as likely to respond positively to removal of conifers to restore oak woodland. Capture rates of Spotted Towhee and Purple Finch, species that use oak woodlands as primary habitat in western Oregon (Hagar and Stern, 2001), also increased after restoration treatment. Increases in capture rates of Spotted Towhees and Western Tanagers were corroborated by the point count data, which indicated increased abundance of these species after restoration treatment (see Point Count Surveys, below).

The total capture rate of all species combined decreased by almost 7 birds per 100 net hours after treatment. Among the species that had lower capture rates after treatment were understory-associated species, such as Bewick's Wren, Common Yellowthroat, Swainson's Thrush, Pacific Wren, and Orange-crowned Warbler (table 1). The treatment involved mechanical activity that reduced understory cover. A decrease in the capture rate of Swainson's Thrush and Pacific Wren after treatment is consistent with the association of both species with dense, closed-canopy forest. In contrast, Bewick's Wren and Black-capped Chickadee are oak-woodland associated species that were predicted to ultimately benefit from oak restoration (Hagar and Stern, 2001). However, the decreases in capture rates of these species from pre- to post-treatment may reflect an immediate negative response to disturbance. It is possible that these species will accrue a long-term benefit from restoration treatment after the stand recovers from the initial disturbance, so continued monitoring is recommended. An additional five species identified by Hagar and Stern (2001) as likely to respond positively to removal of conifers to restore oak woodland (Western Scrub Jay, House Wren, Cassin's Vireo, American Goldfinch and Downy Woodpecker) also contrarily had decreases in capture rates. However, unlike the Bewick's Wren and Black-capped Chickadee, these species were only irregularly captured during the pre-treatment seasons, and decreases from pre- to post-treatment were minor (less than 0.5 birds per 100 net hours; table 1). Therefore, although these species did not show an immediate positive response to treatment, I cannot conclude that they were negatively affected by the treatment because of the high variability in capture rates.

Table 1. Comparison of capture rate (birds per 100 net hours) by species across six breeding seasons at Pigeon Butte before oak woodland restoration (1998–2002, and 2007), and one season post-restoration (2008).

[Species are listed in order of difference in average capture rate between post- and pre-treatment (Diff), from positive (indicating increase after treatment) to negative (decrease after treatment). Species in bold-face font were predicted by Hagar and Stern (2001) as likely to respond positively to conifer removal from oak woodland. Pre-trt ave is the average capture rate for 6 years pre-restoration treatment]

Species	1998	1999	2000	2001	2002	2007	Pre-trt ave	2008	Diff
Rufous Hummingbird	0.22	0.81	1.89	3.02	1.91	0.98	1.47	3.49	2.02
Western Tanager	1.52	0.81	0.52	0.57	0.70	1.96	1.01	1.94	0.93
Spotted Towhee	2.39	2.82	2.93	3.58	3.30	3.92	3.16	4.08	0.92
White-br. Nuthatch	0.00	0.00	0.00	0.19	0.17	0.00	0.06	0.58	0.52
Cedar Waxwing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.39
Western Wood-pewee	0.22	0.20	0.86	0.57	0.52	0.59	0.49	0.78	0.28
Hairy Woodpecker	0.22	0.00	0.17	0.19	0.00	0.20	0.13	0.39	0.26
Red-breasted Sapsucker	0.00	0.00	0.00	0.38	0.35	0.20	0.15	0.39	0.23
Hutton's Vireo	0.22	0.00	0.17	0.19	0.17	0.39	0.19	0.39	0.20
Red-breasted Nuthatch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.19
Dark-eyed Junco	0.22	0.00	0.17	0.19	0.17	0.59	0.22	0.39	0.16
Purple Finch	0.65	0.60	0.69	1.70	0.70	0.78	0.85	0.97	0.12
Brown Creeper	0.87	0.60	2.24	0.75	0.70	1.18	1.06	1.16	0.11
Lazuli Bunting	0.00	0.20	0.34	0.00	0.00	0.00	0.09	0.19	0.10
American Robin	1.52	1.41	2.41	1.89	1.74	1.57	1.76	1.75	-0.01
Pacific-slope Flycatcher	0.22	0.60	0.17	0.19	0.70	1.76	0.61	0.58	-0.02
Steller's Jay	0.00	0.00	0.17	0.00	0.00	0.00	0.03	0.00	-0.03
Northern Flicker	0.00	0.00	0.00	0.00	0.17	0.00	0.03	0.00	-0.03
Willow Flycatcher	0.00	0.00	0.00	0.00	0.17	0.00	0.03	0.00	-0.03
Western Scrub Jay	0.00	0.00	0.00	0.19	0.00	0.00	0.03	0.00	-0.03
House Wren	0.00	0.20	0.00	0.00	0.00	0.00	0.03	0.00	-0.03
Yellow-breasted Chat	0.00	0.20	0.00	0.00	0.00	0.00	0.03	0.00	-0.03
Cassin's Vireo	0.22	0.00	0.00	0.00	0.00	0.00	0.04	0.00	-0.04
Bushtit	0.00	0.00	0.00	0.38	0.00	0.00	0.06	0.00	-0.06
Black-headed Grosbeak	0.00	0.00	0.17	0.19	0.00	0.39	0.13	0.00	-0.13
American Goldfinch	0.00	0.00	0.00	0.75	0.00	0.00	0.13	0.00	-0.13
Brown-headed Cowbird	0.43	0.00	0.00	0.00	0.17	0.20	0.13	0.00	-0.13
Downy Woodpecker	0.43	0.00	0.86	0.00	0.17	0.00	0.24	0.00	-0.24
MacGillivray's Warbler	0.00	0.81	0.00	0.38	0.17	0.59	0.32	0.00	-0.32
Song Sparrow	2.17	1.81	2.41	2.64	0.70	0.78	1.75	1.16	-0.59
Bl.-throated gray Warbler	0.87	0.20	0.52	0.94	1.22	0.39	0.69	0.00	-0.69
Wilson's Warbler	1.30	1.21	0.17	0.57	0.52	0.78	0.76	0.00	-0.76
Bewick's Wren	1.74	2.42	1.89	2.26	2.26	3.92	2.42	1.36	-1.06
Common Yellowthroat	0.43	0.81	2.41	1.51	0.52	0.98	1.11	0.00	-1.11
Swainson's Thrush	6.08	6.05	4.48	7.55	5.39	7.84	6.23	5.05	-1.18
Black-capped Chickadee	1.30	1.61	1.89	1.70	1.91	1.96	1.73	0.39	-1.34
Pacific Wren	1.09	1.81	2.41	1.51	0.70	0.59	1.35	0.00	-1.35
Orange-crowned Warbler	7.38	5.24	4.82	3.96	4.00	4.31	4.95	0.97	-3.98
Total (All spp. combined)	31.68	30.45	34.78	37.92	29.22	36.85	33.48	26.58	-6.90

Breeding Birds

Of the 81 species observed since monitoring began in 1998 (table 2), 28 breed, or likely breed, every year at Pigeon Butte. We observed 60 species of birds at the site during 2008. New species recorded in 2008 were Cooper's Hawk, Peregrine Falcon, and Western Meadowlark. A Cooper's Hawk was observed on two banding dates (12 and 24 June, 2008) and during point counts, suggesting that this species may have been using the Pigeon Butte woodland for nesting.

Table 2. Breeding status of all birds detected at Pigeon Butte banding station during operation of mist-nets.

[Breeding status codes: B = Breeding: Known or suspected to have at least one pair breeding within the station; L = Likely Breeding: Some evidence of breeding, but some uncertainty to breeding status due to infrequent detection; T = Transient: Species was infrequently observed and is likely moving through the site; M = Migrant: Site not within normal breeding range of the species. Birds observed likely are migrants. – indicates that a species was not detected. Species are listed in phylogenetic order. Regularly breeding species are marked with *]

	Breeding Status						
Species	1998	1999	2000	2001	2002	2007	2008
Great Blue Heron	-	-	T	T	T	T	-
Turkey Vulture	T	T	T	L	L	T	T
Canada Goose	-	T	T	T	T	T	T
Osprey	-	-	T	T	T	T	T
Bald Eagle	-	-	-	T	-	T	-
Northern Harrier	T	T	T	T	-	-	T
Sharp-shinned Hawk	T	-	-	-	-	T	-
Cooper's Hawk	-	-	-	-	-	-	T
Red-tailed Hawk	T	L	T	L	T	T	L
American Kestrel	-	-	T	L	T	-	T
Peregrine Falcon	-	-	-	-	-	-	M
Ruffed Grouse	T	-	-	-	-	-	-
Wild Turkey	-	-	-	-	T	-	-
California Quail	-	-	-	-	B	T	T
Northern Bobwhite	-	-	-	-	T	-	-
Sandhill Crane	-	-	-	M	-	-	-
Killdeer	-	T	T	T	T	-	T
Greater Yellowlegs	-	-	-	-	-	M	-
Band-tailed Pigeon	T	T	T	T	L	L	L
Mourning Dove	L	T	L	L	L	B	L
Great-horned Owl	T	-	T	T	-	L	-
Vaux's Swift	-	-	-	T	T	-	-
Rufous Hummingbird*	B	B	B	B	B	B	B
Belted Kingfisher	-	-	-	T	-	-	-
Red-breasted Sapsucker*	B	B	B	B	B	B	B
Downy Woodpecker*	B	B	B	B	B	B	L
Hairy Woodpecker*	B	L	B	B	B	B	L
Northern Flicker	T	L	T	L	B	B	L
Pileated Woodpecker	-	-	-	-	L	T	T
Western Wood-pewee*	B	B	B	B	B	B	B
Willow Flycatcher	-	T	T	T	T	-	-
Pacific-slope Flycatcher*	B	B	B	B	B	B	B
Cassin's Vireo*	B	T	B	B	B	B	L
Hutton's Vireo*	B	L	L	B	B	B	B
Warbling Vireo	T	T	L	T	T	-	T

	Breeding Status						
Species	1998	1999	2000	2001	2002	2007	2008
Steller's Jay	-	-	T	B	T	T	T
Scrub Jay*	L	B	B	B	B	B	B
American Crow	-	L	T	T	T	L	T
Common Raven	T	T	T	L	T	T	T
Tree Swallow	-	L	T	T	T	T	T
Violet-green Swallow	T	T	T	T	T	T	T
Cliff Swallow	-	T	-	-	T	T	T
Barn Swallow	-	T	T	L	T	T	T
Black-capped Chickadee*	B	B	B	B	B	B	B
Bushtit	L	-	T	B	T	B	B
Red-breasted Nuthatch	T	L	L	T	T	B	B
White-breasted Nuthatch*	L	B	B	B	B	B	B
Brown Creeper*	B	B	B	B	B	B	B
Bewick's Wren*	B	B	B	B	B	B	B
House Wren	-	T	L	-	-	-	T
Pacific Wren*	B	B	B	B	B	B	B
Western Bluebird	-	-	-	T	T	-	-
Swainson's Thrush*	B	B	B	B	B	B	B
Hermit Thrush	-	-	-	M	-	-	-
American Robin*	B	B	B	B	B	B	B
Wrentit	-	T	B	B	B	B	-
European Starling	T	L	L	B	L	T	T
Cedar Waxwing*	B	L	B	B	B	B	L
Orange-crowned Warbler*	B	B	B	B	B	B	B
Yellow Warbler	T	T	-	-	-	-	T
Black-throated gray Warbler*	B	B	B	B	B	B	B
Townsend's Warbler	-	M	-	-	-	-	-
MacGillivray's Warbler	-	T	-	T	T	T	-
Common yellowthroat*	B	B	B	B	B	B	B
Wilson's Warbler	B	B	B	B	B	T	T
Yellow-breasted Chat	-	T	T	-	-	T	T
Western Tanager*	B	B	B	B	B	B	B
Spotted Towhee*	B	B	B	B	B	B	B
Savannah Sparrow	-	L	L	-	-	-	-
Song Sparrow*	B	B	B	B	B	B	B
Golden-crowned Sparrow	-	M	-	-	-	-	-
Dark-eyed Junco	L	-	L	T	L	B	B
Black-headed Grosbeak*	B	B	B	B	L	B	L
Lazuli Bunting*	L	B	B	B	B	B	B
Western Meadowlark	-	-	-	-	-	-	T
Brown-headed Cowbird*	B	B	L	B	B	B	L
Northern Oriole	-	-	T	T	T	T	T
Purple Finch*	B	B	B	B	B	B	B
Pine Siskin	-	T	T	-	-	-	-
American Goldfinch*	L	L	B	B	B	L	L
Evening Grosbeak	-	T	-	-	T	-	-

Point Count Surveys

Species composition remained relatively stable throughout all phases of the study, based on point count data. The Spotted Towhee was the most abundant species during all phases of the study, comprising more than 11 percent of the individual birds observed (fig. 1). Swainson's Thrush, Western Wood-pewee, and Orange-crowned Warbler also were among the four most abundant species recorded on point count surveys during the baseline (1994–96) and pre-treatment (2004, 2007) periods. After restoration treatment in 2008, the Western Tanager replaced Swainson's Thrush in the group of three most abundant species (fig. 1). After restoration treatment in 2008, six species comprised more than 50 percent of observed individuals: Spotted Towhee (16 percent), Western Wood-pewee (15 percent), Western Tanager (6.5 percent), Swainson's Thrush (6 percent), Black-throated Gray Warbler (5.5 percent), and Orange-crowned Warbler (5 percent).

Total abundance of all species combined remained consistent across all phases of the study at an average of 15 birds per point count station per visit (table 3). The abundance of three species increased significantly from the baseline to the post-restoration phase (Pacific-slope Flycatcher, Spotted Towhee, and Western Tanager). The brush piles created by the restoration activities and the proliferation of blackberry following canopy opening probably favored habitat conditions for the Spotted Towhee. Tanagers also responded positively to the reduction in canopy density; this response is typical for the species (Hagar and others, 2004). However, as a species associated with dense mid-story cover, the Pacific-slope flycatcher was not expected to respond positively to canopy removal. A spike in the capture rate in 2007 (table 1) may have indicated a productive year for this species. The high abundance we observed in 2008 may have been a carryover effect from the previous year's productivity, rather than an effect of habitat change.

We did not find statistical evidence for a decrease in the abundance of any species. However, Hagar and Stern (2001) hypothesized that abundance of the Pacific Wren may decrease after restoration treatments to remove cover in oak woodlands, so we examined the response of this species. Although the abundance of Pacific Wrens was too low to support statistical analysis, we did observe a decrease in the number of observations from an average of 10.3 (range: 9–11) per year during the baseline period to 3 observations after restoration treatment in 2008. This trend is consistent with the capture data from mist-netting (table 1).

Hagar and Stern (2001) also hypothesized that three species that are strongly associated with oak woodlands, the White-breasted Nuthatch, Cassin's Vireo, and Lazuli Bunting may respond positively to treatments that reduce density of shade-tolerant tree species in oak woodlands. The abundance of all three of these species was too low to indicate any trends according to point count data, although capture rates from mist-net surveys indicated a positive response to the maple removal treatment by the White-breasted Nuthatch (table 1). A stronger response may be observed over time, as habitat conditions that favor these species (such as large-diameter oak boles and limbs for nuthatches, and thriving oak canopy for the vireo and bunting) develop following restoration treatment.

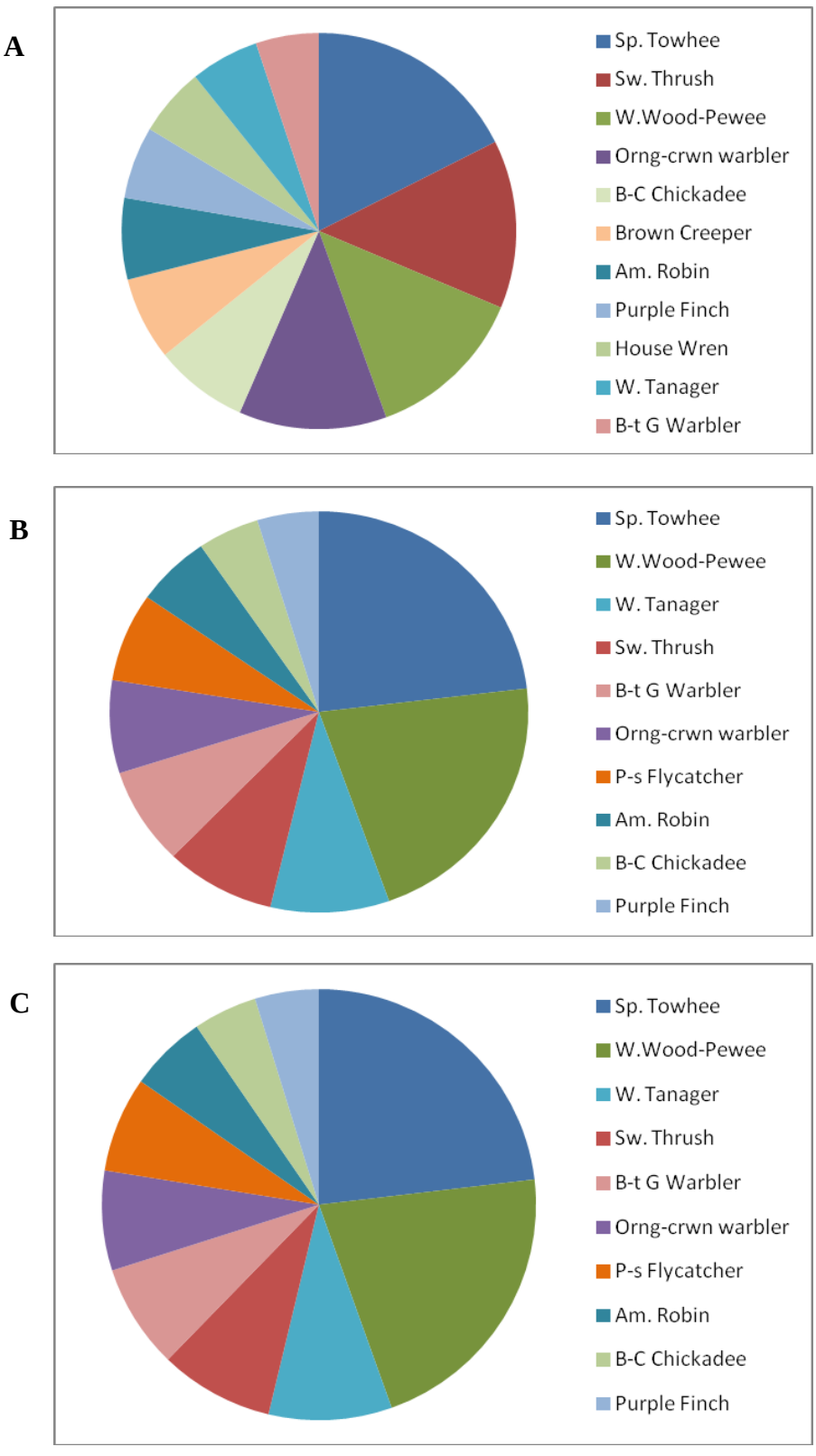

Figure 1. Composition of bird assemblage at Pigeon Butte comprised of 10 most abundant species during (A) Baseline phase (1994–96); (B) Pre-restoration phase (2004, 2007); and (C) Post-restoration phase (2008).

Table 3. Average number (and standard error) of birds per visit per point count station (abundance index) for common species at Pigeon Butte.

[P is the probability associated with the test of the null hypothesis that abundance did not differ among phases of the study (ANOVA). Where P < 0.05 (bold font), different letters indicate significantly different abundance indices between phases (Baseline: 1996–98; Pre-restoration: 2004, 2007; Post-restoration: 2008)]

	Baseline	Pre-restoration	Post-restoration	P
Total (all species combined)	14.97 (0.68)	15.17 (0.73)	15.10 (1.10)	0.983
American Robin	0.63 (0.09)	0.45 (0.16)	0.60 (0.17)	0.605
Black-capped Chickadee	0.72 (0.17)	0.48 (0.17)	0.35 (0.19)	0.486
Black-throated Gray Warbler	0.49 (0.08)	0.62 (0.17)	0.90 (0.23)	0.168
Brown-headed Cowbird	0.43 (0.11)	0.58 (0.18)	0.35 (0.10)	0.694
Black-headed Grosbeak	0.38 (0.08)	0.30 (0.09)	0.25 (0.08)	0.702
Brown Creeper	0.64 (0.11)	0.60 (0.11)	0.55 (0.09)	0.915
Orange-crowned Warbler	1.14 (0.12)	1.00 (0.16)	0.80 (0.28)	0.472
Pacific-slope Flycatcher	0.46 (0.07)**A**	0.87 (0.16)**B**	1.00 (0.44)**B**	**0.031**
Purple Finch	0.56 (0.06)	0.83 (0.10)	0.65 (0.28)	0.138
Spotted Towhee	1.65 (0.13)**A**	1.98 (0.22)**AB**	2.65 (0.37)**B**	**0.014**
Swainson's Thrush	1.29 (0.10)	1.40 (0.18)	1.20 (0.29)	0.764
Western Tanager	0.53 (0.07)**A**	0.98 (0.07)**B**	1.20 (0.24)**B**	**<0.001**
Western Wood-pewee	1.24 (0.13)	1.57 (0.27)	2.10 (0.71)	0.109

Conclusion

Overall, the results of the point counts and mist-netting indicate changes in the song-bird assemblage 1 year after restoration treatments in a portion of the Pigeon Butte woodland. Continued monitoring is necessary to distinguish the short-term effects of response to disturbance and annual variability in bird populations from longer term responses to habitat change. Continued surveys at Pigeon Butte, along with replicated surveys at other oak restoration projects in the Willamette Valley, are needed to provide information about bird response over expanded temporal and spatial scales.

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Appendix 1. Common and scientific names of birds and plants mentioned in the text and tables.

Common Name Birds	Scientific Name Birds
Acorn Woodpecker	*Melanerpes formicivorus*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Spinus tristis*
American Kestrel	*Falco sparverius*
American Robin	*Turdus migratorius*
Bald Eagle	*Haliaeetus leucocephalus*
Band-tailed Pigeon	*Patagioenas fasciata*
Barn Swallow	*Hirundo rustica*
Belted Kingfisher	*Megaceryle alcyon*
Bewick's Wren	*Thryomanes bewickii*
Black-throated gray Warbler	*Setophaga nigrescens*
Black-capped Chickadee	*Poecile atricapillus*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Brown Creeper	*Certhia americana*
Brown-headed Cowbird	*Molothrus ater*
Bushtit	*Aegithalidae*
California Quail	*Callipepla californica*
Canada Goose	*Branta canadensis*
Cassin's Vireo	*Vireo cassinii*
Cedar Waxwing	*Bombycilla cedrorum*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Raven	*Corvus corax*
Common Yellowthroat	*Geothlypis trichas*
Cooper's Hawk	*Accipiter cooperii*
Dark-eyed Junco	*Junco hyemalis*
Douglas-fir	*Pseudotsuga menziesii*
Downy Woodpecker	*Picoides pubescebs*
European Starling	*Sturnus vulgaris*
Evening Grosbeak	*Coccothraustes vespertinus*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Great Blue Heron	*Ardea herodias*
Greater Yellowlegs	*Tringa melanoleuca*
Great-horned Owl	*Bubo virginianus*
Hairy Woodpecker	*Picoides villosus*
Hermit Thrush	*Catharus guttatus*
House Wren	*Troglodytes aedon*
Hutton's Vireo	*Vireo huttoni*
Killdeer	*Charadrius vociferus*
Lazuli Bunting	*Passerina amoena*
MacGillivray's Warbler	*Geothlypis tolmiei*
Mourning Dove	*Zenaida macroura*
Northern Bobwhite	*Colinus virginianus*
Northern Flicker	*Colaptes auratus*
Northern Harrier	*Circus cyaneus*
Northern Oriole	*Icterus galbula*
Orange-crowned Warbler	*Oreothlypis celata*
Osprey	*Pandion haliaetus*
Pacific-slope Flycatcher	*Empidonax difficilis*
Peregrine Falcon	*Falco peregrinus*
Pileated Woodpecker	*Dryocopus pileatus*

Pine Siskin	*Carduelis pinu*
Purple Finch	*Haemorhous purpureus*
Red-breasted Nuthatch	*Sitta canadensis*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Red-tailed Hawk	*Buteo jamaicensis*
Ruffed Grouse	*Bonasa umbellus*
Rufous Hummingbird	*Selasphorus rufus*
Sandhill Crane	*Grus canadensis*
Savanna Sparrow	*Passerculus sandwichensis*
Sharp-shinned Hawk	*Accipiter striatus*
Song Sparrow	*Melospiza melodia*
Spotted Towhee	*Pipilo maculates*
Steller's Jay	*Cyanocitta stelleri*
Swainson's Thrush	*Catharus ustulatus*
Townsend's Warbler	*Setophaga townsendi*
Tree Swallow	*Tachycineta bicolor*
Turkey Vulture	*Cathartes aura*
Vaux's Swift	*Chaetura vauxi*
Violet-green Swallow	*Tachycineta thalassina*
Warbling Vireo	*Vireo gilvus*
Western Bluebird	*Sialia mexicana*
Western Meadowlark	*Sturnella neglecta*
Western Scrub Jay	*Aphelocoma californica*
Western Tanager	*Piranga ludoviciana*
Western Wood-pewee	*Contopus sordidulus*
White-breasted Nuthatch	*Sitta carolinensis (subspecies aculeata)*
Wild Turkey	*Meleagris gallopavo*
Willow Flycatcher	*Empidonax traillii*
Wilson's Warbler	*Cardellina pusilla*
Pacific Wren	*Troglodytes pacificus*
Wrentit	*Chamaea fasciata*
Yellow Warbler	*Setophaga petechia*
Yellow-breasted Chat	*Icteria virens*

Common Name Plants	Scientific Name Plants
Blackberry	*Rubus*
Bigleaf Maple	*Acer macrophyllum*
Douglas-fir	*Pseudotsuga menziesii*
Indian Plum	*Oemleria cerasifomis*
Hazel	*Corylus cornuta*
Oak species	*Quercus*
Oregon White Oak	*Quecus garryanna*
Poison Oak	*Toxicodendron diversilobum*
Snowberry	*Symphocarpus albus*
Swordfern	*Polystichum munitum*
Trailing Blackberry	*Rubus ursinus*