Alameda Creek Riparian Bird Community Occupancy Analyses

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Abstract

Alameda Creek and its tributaries comprise one of the largest watersheds in the South San Francisco Bay. It provides refuge to a number of special status species, including an array of Neotropical birds. To inform habitat management that promotes biological diversity, bird counts were conducted along a 14 mile stretch of Alameda Creek that flows through Sunol Regional Wilderness Area, in Alameda County. Our avian surveys included three stream reaches that are subject to differing levels of recreational, agricultural (grazing) and hydrological regimes.

We used the Variable Circular Point Count method to survey for birds along three different stream reach sections of Alameda Creek during each breeding season from 2007 through 2011. Over the five year study, 2596 bird detections were recorded, including 62 species (7 Focal Species for Riparian Conservation, and 15 Focal Species for Oak Woodland Conservation). We used Multiple-species hierarchical Bayesian occupancy models to assess species occupancy and richness to identify possible associations with stream reach vegetation and landscape characteristics.

Results indicate that the highest species richness, as well as the highest focal species occupancy and richness, occurred along the upper stream reach section of Alameda Creek where elevation is higher and human activity is much lower. Focal species occupancy is similar between the middle and lower reaches, but both are lower than the upper reach, despite the similarity in vegetation among all three reaches. These results point toward elevation, topography, human use patterns, hydrology, and potentially other large-scale factors influencing bird species richness, abundance, and probability of presence rather than habitat structure and composition. Further investigation is needed to evaluate which of these features are likely drivers of this pattern and how we may be able to manage these areas to maximize biodiversity of our riparian avifauna.

Black-headed Grosbeak

Song Sparrow
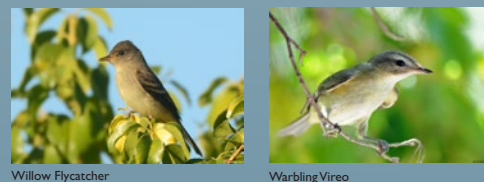
Willow Flycatcher

Warbling Vireo

Wilson's Warbler

Yellow Warbler

Figure 2. Focal Bird Species strongly associated with Riparian Habitat.

Introduction

Riparian areas may be the most important habitat for landbird species in California. Over 60% of the species identified as Neotropical migrants by Partners In Flight used riparian areas in the Western United States during the breeding season or as migratory stopover sites. Estimates are that up to 95% of Western riparian vegetation communities have been lost or degraded over the past century, and many of the bird species associated with these systems have been extirpated or have experienced severe declines. The East Bay Regional Park District (EBRPD), a promoter of sound, science-based wildlife stewardship, studied the breeding bird community along Alameda to aid in decision making for the management of trail users, livestock grazing practices, picnicking areas and group camping, and other recreational activities at the site.

Study Area

The study area is along a 14 mile stretch of the Alameda Creek Watershed at Sunol Regional Wilderness, which is located southeast of the town of Sunol. This property is part of the East Bay Regional Park District, a two-county special district with about 45,200 ha in Alameda and Contra Costa County (Figure 1).
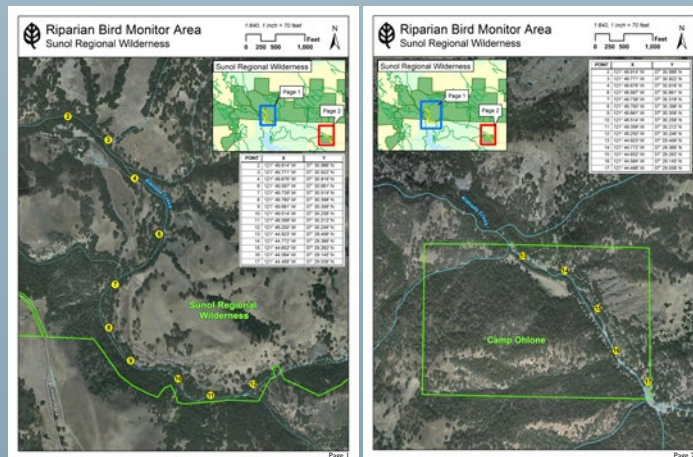

Figure 1. Study Area along Alameda Creek Watershed at Sunol Regional Wilderness in Alameda County.

Methods

EBRPD conducted bird counts from 2007-2011 at 15 riparian points along three sections of the Alameda Creek in Sunol Regional Wilderness Area. Data were collected using a standard multiple distance-bin point count survey method. Three visits to each point were conducted each year. All 15 points were visited on a single day and the order at which the points were counted was alternated between visits. First visits generally occurred in early April across all years, second visits in early May, and third visits in early June. Point-level vegetation surveys were also completed using relevé survey methods and additional spatial habitat and topographical conditions were also assessed by EBRPD staff using GIS.

EBRPD contracted Point Blue Conservation Science to verify the apparent community differences between the three stream reaches using a multiple-species hierarchical Bayesian occupancy models that accounts for variable detectability, and to assess the potential factors that drive these patterns; such as habitat, landscape, and potential disturbances as a result of human activity.

Table 1.

Species Common Name	# individuals detected	# visits detected	Focal group (Tier)
Acorn Woodpecker	158	95	
American Crow	61	35	
American Robin	29	25	
Anna's Hummingbird	27	27	2
Ash-throated Flycatcher	17	17	
Belted Kingfisher	5	4	2
Bewick's Wren	16	14	2
Brown-headed Cowbird	10	4	
Black-headed Grosbeak	139	101	1
Black Phoebe	85	75	
Band-tailed Pigeon	69	4	
Bullock's Oriole	15	14	
Bushtit	72	22	2
Canada Goose	3	2	
California Towhee	128	95	
California Quail	86	34	
Chestnut-backed Chickadee	103	57	2
Common Merganser	2	2	
Dark-eyed Junco	93	74	
Downy Woodpecker	5	5	2
European Starling	51	29	
Great Blue Heron	1	1	
Great Horned Owl	1	1	
Golden Eagle	2	2	
House Finch	11	7	
House Wren	157	123	
Hutton's Vireo	43	40	
Killdeer	2	2	
Lesser Goldfinch	57	40	
Mallard	44	24	
Mourning Dove	58	44	
Northern Flicker	40	39	
Northern Rough-winged Swallow	4	3	
Nuttall's Woodpecker	65	61	
Oak Titmouse	117	79	
Orange-crowned Warbler	63	54	2
Pacific-slope Flycatcher	14	13	2
Red-shouldered Hawk	35	31	
Red-tailed Hawk	4	4	
Song Sparrow	12	10	1
Spotted Towhee	95	83	2
Steller's Jay	138	80	
Tree Swallow	28	14	1
Turkey Vulture	10	9	
Violet-green Swallow	16	11	2
Warbling Vireo	161	126	1
White-breasted Nuthatch	36	26	
Western Bluebird	6	4	
Western Kingbird	1	1	
Western Scrub-Jay	45	27	
Willow Flycatcher	2	2	1
Wild Turkey	70	25	
Wilson's Warbler	30	27	1
Wood Duck	22	13	
Wrentit	4	4	2
Western Wood-Pewee	19	19	2
Yellow Warbler	9	8	1

Table 1. The list of species included in this occupancy model analyses; those in italics were excluded from the analysis. California Partners In Flight riparian and oak woodland focal species are listed in bold (riparian species underlined).

SITE	Lower Stream Reach	Middle Stream Reach	Upper Stream Reach	All sites
Total Individuals	554	707	918	2179
Number of Species (average per point)	26.0	26.6	29.0	27.2
Number of Species (all points)	37	39	41	45
Average number of species (per year per point)	12.0	13.8	16.0	13.9

Table 2. Raw data analyses results across all the years (2007-2011) suggest that the upper stream reach points support more species and more individuals than the lower stream reaches.

Results

We detected a total of 45 species across all 15 points over 5 years (Table 1). To further target the analyses towards species that are associated with high-quality riparian habitat in the Bay Area, we included detection records for only those species likely to be breeding in the study area, rather than those individuals temporarily occupying point count locations. Thus, we removed all raptors, shorebirds (except Killdeer), waterfowl, waders, and large corvids from the analysis (Table 1). Of the remaining species (all species), we further divided off 19 focal species into two categories: Tier 1 consisting of species that are strongly associated with riparian habitat (Figure 2), and Tier 2 consisting of species that are not completely reliant on riparian habitat, but often occur at their highest densities in this habitat (Table 1).

There was considerable overlap of species between stream reaches, with only 8 species not detected at the lower stream reach points compared to the upper stream reach points. For all species, average species richness per point is significantly different between all the stream reaches (Figure 3; low vs. mid p=0.04, low vs. high p=0.001, and mid vs. high p=0.02 using a two tailed T-test), and results suggest that the upper stream reach points support more species and more individuals than the lower stream reaches (Table 2).

Occupancy modeling results indicate that the highest species richness occurs at the points along the upper stream reach of Alameda Creek for all species (Figure 4) and for focal (Figure 5). Derived occupancy of focal species is higher at the middle reach points than the lower reach points, but the baseline occupancy or 'stream reach effect' is nearly equal.
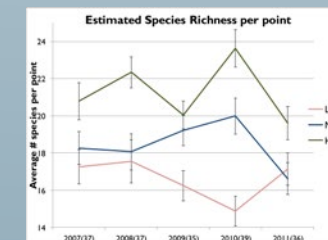

Figure 3. The average species richness per point is significantly different between all the stream reaches (low vs. mid p=0.04, low vs. high p=0.001, and mid vs. high p=0.02 using a two tailed T-test).
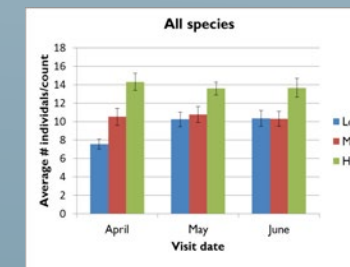

Figure 4. Occupancy modeling results indicate that the highest species richness occurs at the points along the upper stream reach on Alameda Creek.
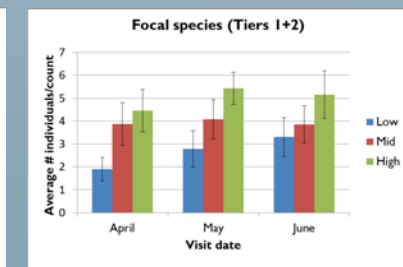

Figure 5. Occupancy modeling results indicate that the highest species richness (Figure 4), as well as the highest focal species occupancy and richness, occurs at the points along the upper stream reach on Alameda Creek (Figure 5).

Acknowledgements

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