

# Using Avian Focal Species to Inform Rangeland Management in California Oak Woodland<sup>1</sup>

Alicia D. Young,<sup>2,3</sup> Breanna Owens,<sup>2</sup> Melissa Odell,<sup>2</sup> Corey Shake<sup>2</sup>, Wendell Gilgert,<sup>2</sup> and Geoffrey R. Geupel<sup>2</sup>

## Abstract

Biological knowledge about bird focal species may be used to inform planning, habitat management, and restoration efforts, with the assumption that the implementation of these species-based recommendations will maintain and enhance healthy functioning habitats and the ecosystems services they provide. Point Blue Conservation Science in collaboration with the Natural Resources Conservation Service (NRCS) state office in California recently formed the Rangeland Watershed Initiative (RWI) to restore ecosystem function by working with ranchers on privately held hardwood rangelands in the foothill regions that surround California's Great Central Valley. An integral component of RWI is to place partner biologists in NRCS offices in key communities to assist in the planning, monitoring and evaluation of farm bill conservation practices. Partner biologists use the Oak Woodland Bird Conservation Plan and the focal species described within to assist ranchers in developing NRCS conservation plans and evaluating the prescribed practices in an adaptive management context. We present examples of how bird focal species are used to prescribe and evaluate rangeland conservation practices in California's Oak woodland.

*Key words:* adaptive management, bird conservation plan, effectiveness monitoring, focal species, rangeland health

## Introduction

Among terrestrial wildlife, birds are recognized as an excellent indicators of habitat condition (Askins 2000, Koskimies 1989, Martin 1995). Because they are diverse, found in almost every habitat type, are high on the trophic system, sensitive to environmental change, and relatively cost-effective to monitor, California Partners in Flight (PIF) has used suites of bird focal species to developed habitat-based conservation plans for seven major habitat types in California (Chase and Geupel 2005). Each suite of species' habitat requirements defines a spectrum of spatial attributes, habitat characteristics, and management regimes representative of a healthy habitat.

Oak woodlands cover 13 percent of California (approximately 2.8 million hectares, or 7million acres). Over eighty percent of these lands are privately owned and primarily managed as working ranches (CDF 2003). California's oak woodlands are a vital landscape providing habitat for over 330 species of birds, mammals, reptiles and amphibians during some stage of their life-cycle (Barrett 1980, Block and Morrison 1998, Verner 1980). With rapid land conversion to orchards (primarily almonds), vineyards, and housing, oak woodlands are one of the most threatened habitats in California. Recent collaborations between ranchers, conservation groups,

---

<sup>1</sup> An abbreviated version of this paper was presented at the Seventh California Oak Symposium: Managing Oak Woodlands in a Dynamic World, November 3-6, 2014, Visalia, California.

<sup>2</sup> Point Blue Conservation Science, 3820 Cypress Drive, Petaluma, CA 94594.

<sup>3</sup> Corresponding author: ayoung@pointblue.org.

and public agencies seek to conserve oak woodlands for wildlife, people and the ecosystem services they provide (for example, California Rangeland Conservation Coalition).

The California Oak Woodland Bird Conservation Plan was developed to promote the conservation and restoration of oak woodland habitat to support long-term viability and recovery of both bird and other native populations of wildlife (CalPIF 2002). The focal species in the plan were identified to guide and prescribe specific habitat management recommendations for use by landowners, managers and practitioners to help maintain and improve the health of hardwood rangelands.

Point Blue Conservation Science's (Point Blue) Working Lands Program recognizes agriculture's significant role in long-term environmental stewardship and is making efforts to increase direct engagement with farmers and ranchers to better understand their needs and challenges while improving overall landscape productivity and health. Ecologically functional rangelands provide for water storage and stable nutrient cycles, in addition to supporting livestock and wildlife.

In this paper we focus on adaptive management decision-making in hardwood rangelands based on data collected on breeding oak woodland focal bird species. We provide examples of how this information can be used for planning and evaluation in a NRCS planning context on hardwood rangelands in California.

## Rangeland watershed initiative

Point Blue formally partnered with the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) in 2011 to implement the Rangeland Watershed Initiative (RWI), with the goal of increasing the NRCS's biological technical capacity and implementation of conservation and wildlife related practices. NRCS works primarily with farmers, ranchers, and forestland owners to voluntarily address resource concerns on privately held land using Farm Bill conservation programs to provide monetary incentives. To date, Point Blue has placed nine cost-shared (public-and privately funded) RWI partner biologists in NRCS field offices throughout California's Great Central Valley and beyond. The biologists provide "value-added" assistance to the NRCS interdisciplinary conservation planning team, by adding specialized fish and wildlife knowledge and habitat management skills to the conservation planning process. In addition, partner biologists provide the monitoring and evaluation component of the NRCS planning process, which is critical for effective adaptive management. Partner biologists are based in NRCS field offices and live in the surrounding communities that the field offices serve; building community relations and landowner trust.

Partner biologists spend, on average, 25 percent of their time in the collection of bird, soil and vegetation data as part of the RWI integrated monitoring program. This program has been designed to evaluate conservation practice effectiveness, inform landowner decision-making and measure ecological function. Participation by ranchers is voluntary and thus far includes 34 properties in the Great Central Valley foothills region. Partner biologists make regular visits to the property using relatively easy and transparent monitoring protocols.

The main objectives of the RWI monitoring and evaluation program include:

- Understanding of the ranch operation, wildlife, and ecosystem through repeated observations.
- Provide ranchers and other stewards of the land with information and tools to monitor ecological function and evaluate prescribed practices.

- Evaluate spatial variation in ecological function within and across rangelands and the relationship to historic and current management practices.
- Establish a baseline that can be used to understand how ecological function on rangelands changes over time in relation to conservation management implementation.

In order to meet these objectives, five key metrics were identified related to ecological function:

1. **Wildlife use and habitat condition.** Bird richness and abundance will be used as indicators.
2. **Vegetation.** Plants convert sunlight into the energy for people, wildlife, and animal agricultural production. We will conduct both qualitative and quantitative assessments of vegetation cover and composition of species and functional groups across the rangelands.
3. **Water infiltration.** Water infiltration is the process of water entering the soil, and is integral to the ability of rangelands to support life.
4. **Soil compaction.** Soil compaction is a measure of how tightly soil particles are packed together. Compacted soils have reduced pore space for water infiltration, water retention, root growth, soil aeration, and seedling germination.
5. **Soil carbon.** Soil organic matter is a primary organic source of carbon in soil, has a high capacity for storing water, and plays a key role in soil stabilization.

Using knowledge of oak woodland focal species habitat and life history requirements paired with inventories and/or results from point count surveys, partner biologists contribute to the development of conservation plans throughout the NRCS nine-step planning process (table 1). The planning process is a collaborative effort that includes NRCS staff, and landowner (or lessee) input and management goals.

**Table 1—NRCS conservation planning process and planning contribution by RWI partner biologists (USDA NRCS 2013)**

<b>NRCS conservation planning process</b>	<b>RWI partner biologist contribution</b>
Step 1. Identify problem and opportunities	Bird presence/absence from current surveys or online resources
Step 2. Determine goals and objectives	Landowner/lessee interview
Step 3. Inventory resources Step 4. Analyze resource data	Current bird surveys
Step 5. Formulate alternatives Step 6. Evaluate alternatives Step 7. Implement the plan	Prescribe practices based on multi-species benefits and desired future outcomes, using California PIF Bird Conservation Plans, focal species accounts, and other current resources
Step 8. Monitor and evaluate Step 9. Re-plan or adjust the plan	Effectiveness monitoring: future bird surveys, including focal species presence/absence, to evaluate the plan and modify as needed

## Study area

The RWI core focus is on hardwood rangeland habitats in the Central Valley foothills of California. While these rangelands are comprised of multiple habitat types, including riparian, grassland, and oak savannah, the vast majority is blue oak (*Quercus douglasii*) woodland. The RWI partner biologists are located strategically in NRCS offices to work with those ranchers and producers that own or manage lands in the Sierra Nevada and Coastal Range foothills surrounding the Central Valley (fig. 1). Participants in the RWI through 2014 included ranches in eight valley foothill counties, representing 34 properties and 29 landowners/lessees. Size of properties ranged from 89 to 5260 hectares, and ranged from properties surrounded by intensive non-agriculture to those that form part of an extensive oak woodland habitat.

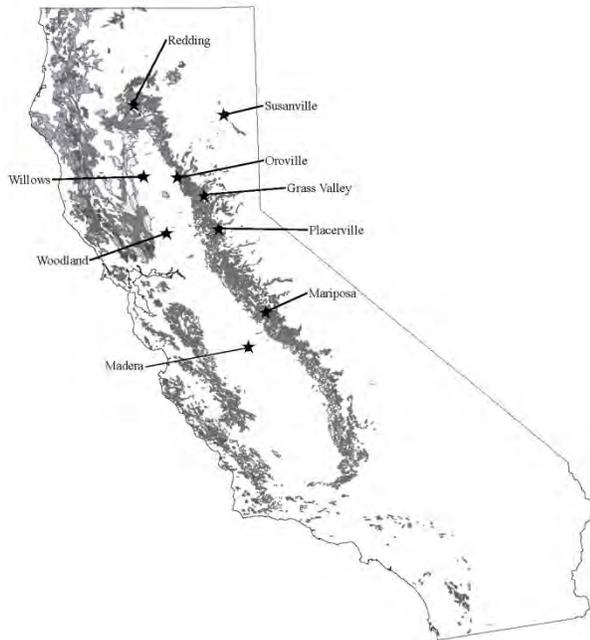


Figure 1—NRCS field office location of Point Blue Rangeland Watershed Initiative partner biologists.

While blue oak woodlands currently cover over 1.2 million hectares (3 million acres) in California, they are facing increasing threats by conversion and regeneration problems (Bolsinger 1988, Muick and Bartolome 1987). There is no one clear answer as to why regeneration rates are poor. Numerous causes have been cited, including increased depredation by animals and insects, associated vegetation changes, incompatible livestock grazing, fire suppression, and climate change. No matter the cause, private blue oak woodland owners will need to be part of the solution for improving oak regeneration and rangeland habitat health. The RWI objectives, aimed at the ultimate goal of improved rangeland health, simultaneously promote economic sustainability of current and future generations of ranchers while continuing to provide valuable contiguous habitat for wildlife.

## **Oak woodland focal species**

The California PIF approach to focal species selection for each of the seven habitat-based Bird Conservation Plans was to select a suite of species whose requirement, as a group, “define different spatial attributes, habitat characteristics and management regimes representative of a healthy system” (Chase and Geupel 2005). In order to include species with different vegetative and habitat element requirements to complete their life cycle, species were chosen to include as many of the following criteria as possible:

- Use a given habitat type as their primary breeding habitat.
- Breeding requirements represent a full range of successional stages.
- Have a special management status or have experienced a reduction from their historical breeding range.
- Commonly breed throughout a given habitat type, allowing adequate sample size for statistical comparisons, and therefore, the ability to assess response to management or habitat changes.

Following these criteria, the various habitat focal species groups tend to include species at risk, those species considered umbrella or keystone, and species that are common and abundant for a given habitat.

The California PIF Oak Woodland Bird Conservation Plan (CalPIF 2002) recognizes 22 bird species as focal species. These species represent an array of life cycle requirements (table 2), and require a variety of habitat elements within oak woodlands (table 3). Bioregionally-based population targets have been developed for several of the oak woodland focal species. These numerical targets were based on all available data and use the highest recorded densities for that species for the bioregion. As part of the RWI, subsets of these species are used—based on geographic location, specificity to blue oak woodlands, and conformity to standardized monitoring protocols—to evaluate the health of hardwood rangelands and guide habitat management recommendations.

**Table 2—Oak woodland focal species in California, with information on their use of acorns, nesting substrate, general foraging habitat in oak woodlands, and whether the species is endemic to California (reproduced from CalPIF 2002)**

Species	Consumes acorns?	Caches acorns?	Nest <sup>a</sup>	Foraging habitat in oak woodlands	Migratory status
Wood Duck ( <i>Aix sponsa</i> )	Yes		2° Cavity	Wooded Streams	
Red-shouldered Hawk ( <i>Buteo lineatus</i> )			Platform	Woodlands	
Wild Turkey ( <i>Meleagris gallopavo</i> ) (I <sup>b</sup> )	Yes		Ground	Woodlands	
Band-tailed Pigeon ( <i>Columba fasciata</i> )	Yes		Platform	Woodlands	
California Quail ( <i>Callipepla californica</i> )	Yes		Ground	Woodland-shrub	
Northern Pygmy Owl ( <i>Glaucidium gnoma</i> )			2° Cavity	Woodlands	
Acorn Woodpecker ( <i>Melanerpes lewis</i> )	Yes	Tree, many	1° Cavity	Woodlands	
Lewis's Woodpecker ( <i>Melanerpes lewis</i> )	Yes		1° Cavity	Woodlands	
Nuttall's Woodpecker ( <i>Picooides nuttallii</i> )	Yes		1° Cavity	Woodlands	Endemic <sup>c</sup>
Ash-throated Flycatcher ( <i>Myiarchus cinerascens</i> )			2° Cavity	Open Woodlands	
Western Scrub-Jay ( <i>Aphelocoma californica</i> )	Yes	Ground, many	Cup	Woodland-Scrub	
Yellow-billed Magpie ( <i>Pica nuttalli</i> )	Yes	Ground, few	Cup	Woodlands	Endemic
Oak Titmouse ( <i>Baeolophus inornatus</i> )	Yes	Tree, few	2° Cavity	Woodlands	Endemic <sup>c</sup>
White-breasted Nuthatch ( <i>Sitta carolinensis</i> )	Yes	Tree, few	2° Cavity	Woodlands	
Bewick's Wren ( <i>Thryomanes bewickii</i> )			2° Cavity	Woodland-Scrub	
Blue-gray Gnatcatcher ( <i>Polioptila caerulea</i> )			Cup	Woodlands	
Western Bluebird ( <i>Sialia Mexicana</i> )			2° Cavity	Open Woodlands	
California Thrasher ( <i>Toxostoma redivivum</i> )			Cup	Woodland-Scrub	Endemic <sup>c</sup>
European Starling ( <i>Sturnus vulgaris</i> ) (I)			2° Cavity	Agriculture edge	
Hutton's Vireo ( <i>Vireo huttoni</i> )			Cup	Woodlands	
California Towhee ( <i>Pipilo crissalis</i> )			Cup	Woodland-Scrub	Endemic <sup>d</sup>
Lark Sparrow ( <i>Chondestes grammacus</i> )			Ground	Grass-Woodland	

<sup>a</sup> Cavity-nesting species differ as to whether they excavate their own cavities (1° cavity nester) or they take over disused nests or naturally occurring cavities (2° cavity nester).

<sup>b</sup> (I) denotes an introduced, nonnative species.

<sup>c</sup> Also occurs in Baja California, Mexico.

<sup>d</sup> Also occurs in Baja California, Mexico, and extreme southern Oregon.

**Table 3— Essential habitat elements for focal species, based on California Wildlife habitat Relationships System Version 7.0 (reproduced from CalPIF 2002<sup>a</sup>)**

Focal Species	Acorns	Cavities	Trees	Shrub	Grass/herb	Snags	Brush piles	Water/ riparian
Wood Duck ( <i>Aix sponsa</i> )		X						X
California Quail ( <i>Callipepla californica</i> )			X	X	XX		X	X
Red-shouldered Hawk ( <i>Buteo lineatus</i> )			X	X				X
Northern Pygmy Owl ( <i>Glaucidium gnoma</i> )		X	X			X		
Band-tailed Pigeon ( <i>Columba fasciata</i> )	X		X					
Acorn Woodpecker ( <i>Melanerpes lewis</i> )	X	X	X			X		X
Lewis's Woodpecker ( <i>Melanerpes lewis</i> )	X	X	X					
Nuttall's Woodpecker ( <i>Picoides nuttallii</i> )		X	X			X		
Ash-throated Flycatcher ( <i>Myiarchus cinerascens</i> )		X	X	X				
Western Scrub-Jay ( <i>Aphelocoma californica</i> )	X		X	X				
Yellow-billed Magpie ( <i>Pica nuttalli</i> )	X		X					X
Oak Titmouse ( <i>Baeolophus inornatus</i> )		X	X			X		
White-breasted Nuthatch ( <i>Sitta carolinensis</i> )		X	X			X		
Bewick's Wren ( <i>Thryomanes bewickii</i> )	X		X	X				
Blue-gray Gnatcatcher ( <i>Polioptila caerulea</i> )			X	X				
California Thrasher ( <i>Toxostoma redivivum</i> )			X	X				
Western Bluebird ( <i>Sialia mexicana</i> )		X	X		X			X
Hutton's Vireo ( <i>Vireo huttoni</i> )		X	X			X		X
Lark Sparrow ( <i>Chondestes grammacus</i> )					X			
California Towhee ( <i>Pipilo crissalis</i> )				X				X

<sup>a</sup> Includes selected elements classified by CWHR as "essential" or "secondary essential".

## Methods

The RWI follows standardized avian survey protocols to collect information on ranch-specific bird populations (Ralph and others 1993). The most commonly utilized method was variable radius point counts. Point counts can be used to detect changes in local (and regional) bird populations from year to year, including species composition differences among habitat types, species abundance, and local habitat relationships.

### *Point count surveys*

Point count surveys followed guidelines described in Ralph and others (1995). In summary, we sampled each point count location for 5 minutes, and placed detections within one of six bins based on the distance from the observer to the initial detection of that bird. The distance bins were defined in meters as follows: 0 to 10, 10 to 20, 20 to 30, 30 to 50, 50 to 100, and greater than 100. All birds detected were recorded and initial detection cue (song, visual, call or wing noise) for each individual was also recorded. Counts were conducted from local sunrise until approximately 3 hours after sunrise (in other words, peak singing hours), and did not occur in inclement weather. All point count stations were located at least 200 m apart and were surveyed at least twice during the peak months of the breeding season (April to early July). Timing of surveys varied by elevation, latitude, and seasonal conditions throughout the RWI study area.

### *Analysis: point count data*

Data analysis was restricted to the subset of California PIF oak woodland focal species encountered. In addition, we excluded all birds detected at greater than 50 m from the observer (to avoid observe biases), and species flying over the sampling locations but not actively using the habitat. The indices of bird species richness were defined as the total number of species detected per point across visits in one year. The indices of bird abundance were defined as the mean number of individuals detected per point per visit in one year – the same as the California PIF definition of species population targets (CalPIF 2002).

## Results

Point Blue has developed several tools and products to help determine likelihood of focal species presence and communicate rangeland habitat management recommendations to landowners and managers. The California Avian Data Center (CADC) (<http://data.prbo.org/cadc2/>) is the online regional node of the Avian Knowledge Network (<http://www.avianknowledge.net/>). CADC integrates data on birds and ecosystems to improve conservation outcomes today and in the future. Online tools and information include links to the California PIF Bird Conservation Plans, and interactive maps to explore: avian data summaries, modeling of bird distribution response to climate change, and predicted current bird focal species occupancy in the Central Valley region.

Another tool available to landowners and land managers is the Oak Woodland Healthy Habitat Guide (fig. 2). This guide provides a brief overview of the focal species concept, photographs and descriptions of oak woodland bird species, nesting and foraging locations by species, and tips for improving or maintaining habitat features and vegetative layers. These habitat recommendations are not ranch-specific, but widely accepted as beneficial habitat improvements and management activities and can be used for planning as required by NRCS farm bill program implementation. They include:

- Retain dead or decaying trees and snags to provide cavity and granary tree locations.
- Restore understory vegetative layers and habitat elements by retaining downed woody material, creating brush piles, and encouraging shrub regeneration.
- Foster the regeneration of blue oaks by protecting oak seedlings and being cognizant of grazing timing and intensity in areas of dense seedlings.
- Adjust grazing scheme from year to year to avoid grazing the same field at the same time of year over and over.
- Control noxious and invasive weeds and encourage the distribution of native perennial grasses.
- Manage for a mosaic of tree canopy cover, including patches of over 40% canopy.
- Limit tree thinning to those oaks that are undersized and poor acorn producers.



## Keeping Oak Woodlands Healthy



*If the birds are there, the oak woodland is healthy.*

	Western Bluebird	California Quail	Western Scrub-Jay	Yellow-billed Magpie	Lark Sparrow	HOW YOU CAN HELP
Photos Courtesy of Tom Gray						
Tips for a Healthy Habitat	Retain cavity trees or snags. Remove non-native birds nesting in bluebird habitats.	Keep or plant shrubs and downed wood. Create a healthy ground layer.	Keep or plant shrubs and plant or retain acorn or nut producing trees.	Keep large mature trees. Create healthy ground layers and rangelands.	Keep or plant shrubs, native bunch grasses, and keep a healthy ground layer.	
How to Identify	7 inch bird with blue head and upper-parts with red breast and gray belly.	Plump birds with gray-brown backs. Male has black throat and plume on forehead. Often found in groups.	Gray back with blue upper-parts and tail, gray underside. Dark cheek patch and thick beak.	20 inch black and white body, long dark tail, thick yellow beak. White patches on wings noticeable in flight.	6 inch bird bold chestnut head stripes, white underside, white outer tail feathers noticeable in flight.	
Nest Site Layer in Forest	Occupies empty cavity holes in trees. Usually in 20% or less canopy cover.	Under brush or dense vegetation. Nest is placed in a depression on ground.	Uses tops of shrubs or low in trees, hidden by mistletoe or dense vegetation.	Large dome-shaped nest, high in the top canopy or far out on high limbs.	On ground or in a low shrub. Cup nest made of grass, weedy stems and hair.	
Feeding Forest Layers	Eats ground-dwelling insects although will catch flying insects. Rely on berries in winter.	Feeds around or near shrubs for escape cover. Eats seeds, nuts and berries, sometimes insects.	Feeds on insects and seeds on the ground, gathering nuts and fruits in the fall. Also eats eggs and lizards.	Searches ground near woodlands for insects, grains, carrion and small mammals.	Walks on the ground searching for seeds and insects.	

**Scrub Jays Help Oak Forests Survive**

The *Western Scrub Jay* "plants" acorns for winter food, but many are never eaten and instead grow into oak seedlings. Without jays, the oaks don't grow. The jays need shrubs amongst the trees to feed and raise their young. If shrubs are absent, Scrub Jays are too, and the next generation of oak trees may not be planted.

**Critical Oak Woodland Forest Layers:**

- Top Canopy: Pines, large mature oaks
- Mid-canopy: Oaks, snags, shrub tops
- Interior Mid-canopy: Oak interior, shrubs, cavities, snag trees
- Understory/Ground: Bunch grass, low shrubs, downed wood, leaf litter

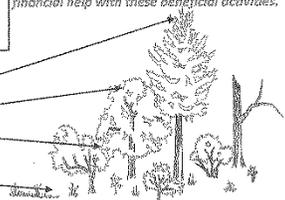
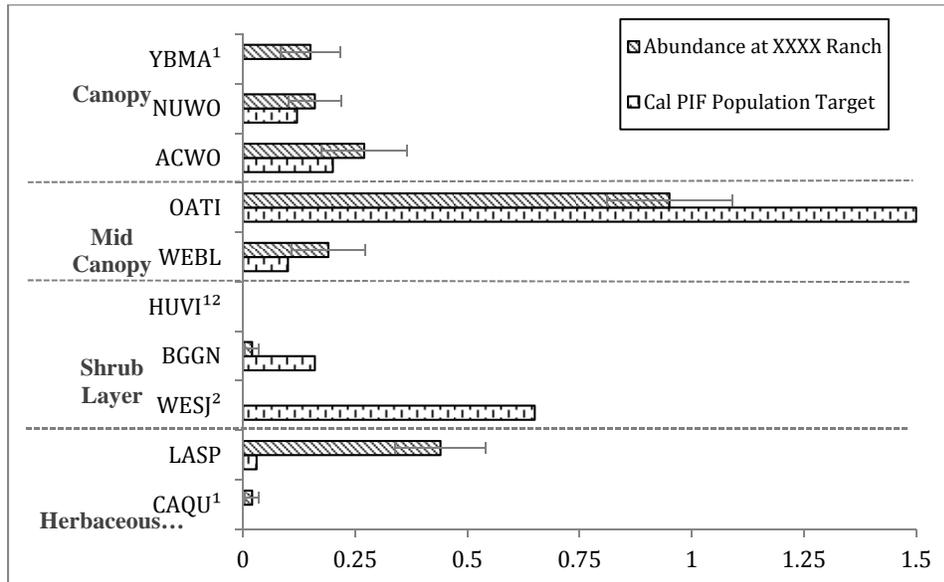


Figure 2—Oak Woodland Healthy Habitat Guide developed by Point Blue Conservation Science.

For those rangelands where we have collected focal species point count data, we can provide ranch-specific information on focal species presence, abundance, and distribution across the property. Habitat recommendations are tailored to the goals and needs of the land manager and specific attributes of the rangeland.

Figure 3 is an example of a subset of focal species abundance results from a ranch in the Sacramento Valley. It includes, when available, the focal species population targets provided by the California PIF Oak Woodland Bird Conservation Plan. In this example, the species associated with the canopy, mid-canopy, and understory layer are present, and for the most part, similar in abundance to the PIF population targets. However, focal species associated with the shrub layer are in very low numbers or absent – a strong indication that the shrub layer is a limiting factor for birds at this ranch. While this summary of ranch-wide bird populations is informative, stratified results (often by field) of species richness, overlaid on a distribution map, allowed us to identify specific areas to focus upon (fig. 4). For example, areas or fields where focal species richness was low were given habitat improvement recommendations, based on the habitat-specific focal species that were missing from survey results (in other words, shrub associated species). Conversely, habitat maintenance was encouraged in areas where focal species richness was high. By using a distribution map, additional factors such as soil type, slope, aspect, and adjacent habitats, were also taken into account when management recommendations were suggested, and habitat improvements could be better prioritized and visualized by the ranch manager.



4-letter bird species codes: YBMA = Yellow-billed Magpie, NUWO = Nuttall’s Woodpecker, ACWO = Acorn Woodpecker, OATI = Oak Titmouse, WEBL = Western Bluebird, HUVI = Hutton’s Vireo, BGGN = Blue-gray Gnatcatcher, WESJ = Western Scrub Jay, LASP = Lark Sparrow, CAQU = California Quail.

<sup>1</sup> No California PIF population target available.

<sup>2</sup> No detections at XXX Ranch.

Figure 3—Oak Woodland bird focal species average bird abundance index ( $\pm 1$  SE) with nesting layer at a ranch participating in the Rangeland Watershed Initiative and California PIF population targets.



Oak Woodland Focal Species Richness Distribution  
XXXX Ranch

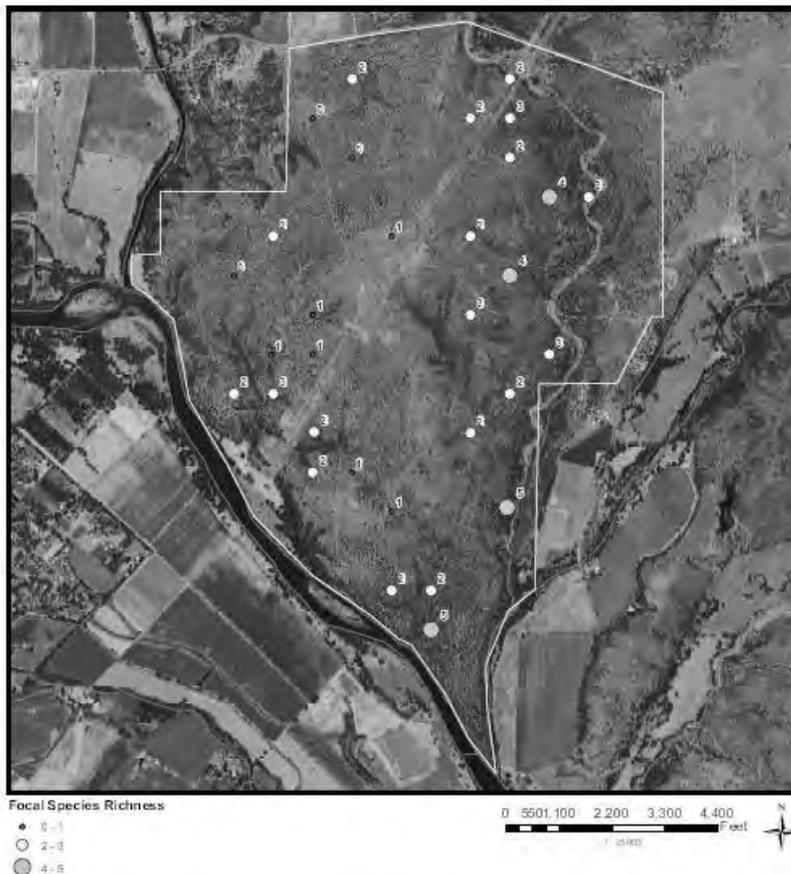


Figure 4—Oak woodland bird focal species abundance and distribution at a ranch participating in the Rangeland Watershed Initiative.

## Conclusions

California Partner in Flight focal species were selected to represent species whose requirements define different spatial attributes, habitat characteristics, and management regimes representative of a healthy oak woodland ecosystem. Biological knowledge about the life characteristics and habitat requirements of focal species can be used to inform habitat management and restoration efforts, while maintaining and enhancing the overall ecological community. As an integral part of the RWI, avian focal species surveys are used to inform range management in oak woodlands. Point Blue's partnership with the Natural Resource Conservation Service allows partner biologists located in NRCS field offices to effectively interact with managers of privately-held oak woodlands throughout California on a regular basis, as well as provide technical assistance, and monitor progress of habitat improvement projects. By incorporating the goals of the land managers and property-specific attributes and limitations, these recommendations are geographically unique to the property and help to achieve sustainability for the future of ranching, oak woodland habitats and the species that inhabit them.

## References

- Askins, R. 2000. **Restoring North America's birds: lessons from landscape ecology**. New Haven, CT: Yale University Press. 320 p.
- Barrett, R.H. 1980. **Mammals of California oak habitats – management implications**. In: Plumb, T.R., tech. coord. Proceedings of the symposium on the ecology, management, and utilization of California oaks. Gen. Tech. Rep. PSW-44. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station: 275–291.
- Block, W.M.; Morrison, M.L. 1998. **Habitat relationship of amphibians and reptiles in California oak woodlands**. *Journal of Herpetology* 32: 51–60.
- Bolsinger, C.L. 1988. **The hardwoods of California's timberlands, woodlands, and savannas**. Resource Bulletin PNW-148. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 148 p.
- California Department of Forestry and Fire Protection [CDF]. 2003. **The changing California: forest and range 2003 assessment, assessment summary**. State of California, Sacramento, CA: The Resources Agency, Fire and Resource Assessment Program (FRAP).
- California Partners in Flight [CalPIF]. 2002. **Version 2.0. The oak woodland bird conservation plan: a strategy for protecting and managing oak woodland habitats and associated birds in California** (S. Zack, lead author). Point Reyes Bird Observatory, Stinson Beach, CA. <http://www.prbo.org/calpif/plans.html>. (21 February 2015).
- Chase, M.K.; Geupel, G.R. 2005. **The use of avian focal species for conservation planning in California**. In: Ralph, C.J.; Rich, T.D., eds. Proceedings of the third international partners in flight conference. Gen. Tech. Report PSW-GTR-191. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 130–142.
- Koskimies, P. 1989. **Birds as a tool in environmental monitoring**. *Annales Zoologici Fennici* 26(3): 153–166.
- Martin, T.E. 1995. **Summary: model organisms for advancing and understanding of ecology and land management**. In: Martin, T.E., Finch, D.M., eds. Ecology and management of neotropical migratory birds: a synthesis and review of critical issues. New York: Oxford University Press: 477–484.
- Muick, P.C.; Bartolome, J. 1986. **Oak regeneration on California's hardwood rangelands**. *Transactions, Western Section of the Wildlife Society* 22: 121–125.
- Ralph, C.J. [and others]. 1993. **Handbook of field methods for monitoring landbirds**. Gen. Tech. Rep. PSW-GTR-144. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 41 p.
- Ralph, C.J.; Sauer, J.R.; Droege, S., tech. eds. 1995. **Managing bird populations by point counts**. Gen. Tech. Rep. PSW-GTR-149. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 187 p.
- U.S. Department of Agriculture, Natural Resource Conservation Service [USDA NRCS]. 2013. **Title 180 - National Planning Procedures Handbook**. Washington, DC: Natural Resources Conservation Service, 180-VI-NPPH, Amend. 5.
- Verner, J. 1980. **Birds of California oak habitats – management implications**. In: Plumb, T.R., tech. coord. Proceedings of the symposium on the ecology, management, and utilization of California oaks. Gen. Tech. Rep. PSW-44. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Research Station: 246–264.