

The Oak Woodland Bird Conservation Plan

*A Strategy for Protecting and Managing
Oak Woodland Habitats and Associated Birds in California*



*A Project of California Partners In Flight and
PRBO Conservation Science*



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Executive Summary

This Oak Woodland Bird Conservation Plan is a collaborative effort of California Partners in Flight (CalPIF). It has been developed to guide conservation policy and action on behalf of oak woodland habitats and wildlife. The plan has focused on data concerning bird species that are dependent on oak woodlands, but conservation recommendations have broad applicability for all oak woodland habitats and, if implemented, would benefit many oak woodland species. The plan, which includes both this written document and an associated web site, is meant to provide a source of information on oak woodland bird conservation for landowners, managers, agencies and non-governmental organizations.

This conservation plan, along with the associated Geographic Information System (GIS) database of oak woodland habitats and monitoring data maintained at the Point Reyes Bird Observatory (PRBO), is the first iteration of a continuous process of updating habitat conservation recommendations based on the latest scientific monitoring and research data. This is not a regulatory document, nor does it represent the policies of any agency or organization.

A major extension of this conservation plan is the on-line GIS database of oak woodland monitoring projects and species breeding status available through the CalPIF section of PRBO's website at <http://www.prbo.org/calpif/>. Contributing to and managing data in this database is accomplished through a web interface, to which access is available by request. This database, in particular, is used for cataloguing new information and new analyses and for updating conservation recommendations and goals. Analyses of bird data will be posted on the PRBO website (www.prbo.org), periodically updated, and made available for use by the public. Therefore, this conservation plan is a dynamic, "living" document.

Biological Need

Oak woodlands have the richest wildlife species abundance of any habitat in California, with over 330 species of birds, mammals, reptiles, and amphibians depending on them at some stage in their life cycle (Verner 1980; Barrett 1980; Block and Morrison 1998). Wilson and others (1991) suggest that California oak woodlands rank among the top three habitat types in North America for bird richness. Oak woodlands are able to sustain such abundant wildlife primarily because they produce acorns, a high quality and frequently copious food supply (Koenig 1990; Ostfeld et al. 1996; McShea and Schwede 1993, and McShea 2000). Oaks also provide important shelter in the form of cavities for nesting (Waters 1988; Purcell 1995). Moreover, oak woodlands are among the most highly prized of California's



Acorn Woodpecker photo by Ian Tait

landscapes, for both aesthetic reasons and utilitarian needs such as firewood collection and grazing.

Yet, as with most of California's native habitats, oak woodlands have not escaped impacts from intensive human settlement: today only two-thirds of California's original oak woodlands remain (approximately 7 million acres). Of those, only about four percent enjoy protected status (Thomas 1997). This trend continues today, through loss of oak woodlands to urbanization and intensive agriculture such as vineyards (Tobin 1999, Larson 1999).

If loss of oak woodlands could be stemmed through protection and management incentives the problem might not be viewed as dire. However, oak woodlands are also faced with more insidious threats. Even today's existing oak woodlands in many cases are not regenerating naturally (i.e. young trees are not establishing to replace older trees as they senesce and die). Thus Californians continue to lose their oak woodland heritage, even in sites that are protected from development.

The causes of lack of natural regeneration are many, varied and inter-related in complex ways that are not completely understood. These include fire suppression (Biswell 1989; Stephens 1997) and overgrazing (Fleischner 1994; Belsky et al. 1999), both of which contribute to invasion of non-native annual grasses and cause long-term changes in habitat structure (Barnhart et al. 1996). Annual grasses tend to outcompete native perennials and young oak seedlings for soil moisture, while herbivory by cattle can also stymie oak sapling development (Hamilton 1997).

The newest threat to California's oak woodlands is Sudden Oak Death (SOD). This pathogen started attacking California oaks in 1985 and became a full-scale epidemic by 1999. In the summer 2000, a previously unknown species of *Phytophthora*, the same genus responsible for the Irish potato famine, was identified as the pathogen causing SOD (Hansen et al. 2000). Oaks of many species infected with SOD die quickly, and there are currently no known cures or prophylactic measures for stopping the disease. The disease is currently present over more than 350 miles of California coastal forests (and into southern Oregon) and will most likely continue to spread (as it has recently to bigleaf maples in the Sierras).

Lack of recruitment of young oaks combined with the SOD epidemic affect 7 of the 10 acorn-bearing species of oak tree in California, including tanoak (Table 4-1). Thus, the combined effect of these two problems on native wildlife populations is likely to be considerable. Surprisingly, several recent assessments of biodiversity and environmental problems in the United States make no special mention of the major problems facing California's oak woodlands (e.g., Noss et al. 1995, Mac et al. 1998, Ricketts et al. 1999, Stein et al. 2000).

Mission and Objective

The mission of Partners in Flight (PIF) is to stop the decline of, maintain, or increase healthy populations of landbirds in North America. This mission translates into identification of habitat conservation and management priorities for bird species at risk in California, a priority of the associated Joint Ventures. By developing the Oak Woodland Bird Conservation Plan, California PIF (CalPIF) seeks to promote conservation and restoration of oak woodland habitat to support long-term viability and recovery of both native bird populations and other native species. The goals of the CalPIF oak woodland conservation effort are to:

- Define the conservation implications of three key problems facing California's oak woodlands: the long-term lack of recruitment, the new pathogen (*Phytophthora* sp.) that causes Sudden Oak Death, and the loss of oak woodland habitats.
- Collect data and analyze existing scientific information to inform land managers, planners, and the public of the complex and interrelated issues affecting California's oak woodlands and their management.
- Provide technical support for private landowners, land managers (state, federal, and non-profit), funders, agencies, and conservation organizations for assisting in the selection, design, and implementation of the highest priority conservation and land management actions.
- Support and inform efforts to increase the quantity (acreage) and quality (ecosystem function) of oak woodland habitat in California by providing funding information and promoting on-the-ground conservation projects.

Designing conservation efforts for oak woodland habitats based on the needs of birds is useful because birds occupy a diverse range of niches within oak woodlands: from those that nest on the ground to those that nest in the cavities of mature trees, those that feed primarily on insects and those that rely heavily on the acorn mast from year to year. Evidence and experience indicate that by managing for a diversity of birds, diverse oak woodland habitat structure will be maintained and many other elements of terrestrial biodiversity will be conserved (Martin 1995, Askins 2000).

CalPIF recognizes that the subject of land management and land use, whether on private or public lands, can be contentious. Because 85% of all oak woodlands are on private lands (Griffin and Muick 1990), CalPIF supports the need for land managers and landowners to have flexibility to develop systems that accommodate their needs while seeking to achieve the desired habitat characteristics that will maximize benefits to wildlife. CalPIF supports and will seek to maximize the benefits of new and ongoing efforts, such as the Integrated Hardwood Range Management Program, to work with viticulturists, ranchers, and public land managers with the ultimate goal of ensuring a thriving oak woodland heritage for future generations of Californians.

Findings and Recommendations

This Conservation Plan has been developed collaboratively by the leading bird researchers in California through a process designed to:

- capture the conservation needs of the complete range of oak woodland habitat types throughout the state, and
- develop biological conservation objectives for selected oak woodland bird species.



Lark Sparrow

PRBO

At over 120 sites throughout California, monitoring data on oak woodland birds have been collected continuously over the past ten years. This document places an emphasis on a suite of seven bird species chosen because of their conservation interest to serve as focal species representative of the range of oak habitats in the state (Acorn Woodpecker, Blue-gray Gnatcatcher, Lark Sparrow, Oak Titmouse, Western Bluebird, Western Scrub-Jay, Yellow-billed Magpie). Visit <http://www.prbo.org/calpif/> to view maps of oak woodland habitat coverage, focal

species ranges and PIF monitoring sites in California. Preliminary analyses of the seven focal species' habitat requirements reveal the following:

- Four of seven focal species have experienced significant population declines, local extirpations, or both. The only species that appears to be significantly and consistently increasing is the Western Scrub-Jay, a bird that adjusts readily to urbanization but is also an important nest predator of many other native bird species.
- Loss of habitat or habitat structure (such as dead standing trees, mature trees with cavities, or a shrubby understory component) is implicated as a likely cause of decline and/or other problems for five of the seven focal species.

Accordingly, a series of conservation recommendations are provided, focusing primarily on protection, restoration and management of habitat that will facilitate and promote natural oak woodland regeneration. Other recommendations focus on the need to promote nest success, by retaining mature oaks in altered landscapes to provide nest cavities and by keeping down the number of native and introduced nest predators. Species-specific conservation recommendations for the Western Bluebird, Blue-gray Gnatcatcher and Acorn Woodpecker are also defined.

High priority conservation areas or “portfolio sites,” distinguished by their protected status and potential for managing oak woodland habitat through restoration, are identified within

the ten bioregions of California as defined by the California Biodiversity Council. Setting conservation goals by bioregion facilitates planning site-specific projects in a broader context, and provides a comparable framework to other conservation planning efforts such as the North American Bird Conservation Initiative (NABCI). Setting and achieving conservation goals by bioregion will:

- Ensure that a suite of ecological communities representative of California's diversity will be conserved throughout the state.
- Ensure the broadest range of biodiversity and locally adapted races of species will be conserved.
- Facilitate action at the local level.

California's Oak Woodland Conservation Act provides funds for protection and conservation of oak woodlands. This program is administered by the Wildlife Conservation Board. It offers financial incentives to private landowners to protect and promote biologically functional oak woodlands over time. Conservation easements, land improvements, public education and outreach are some of the activities that may be funded by AB 242, initiated by the California Oak Foundation and carried by Assemblywoman Helen Thomson.

Finally, scientific efforts for conservation have little impact without the support of affected local communities, including private landowners, government land managers, and the general public (Askins 2000). This is particularly true for oak woodlands in California, which are 85% privately owned. To gain crucial public support, research and management programs must share their findings and involve the interested parties at all levels of the conservation enterprise. Therefore, this plan provides a list of current programs focusing on oak woodland conservation and management, educational and volunteer opportunities for children and adults, and a list of resources and organizations for those interested in involving their families and communities in oak woodland conservation.

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Lark Sparrow (*Chondestes grammacus*) by Diana Humple, Point Reyes Bird Observatory

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Chapter 1. Introduction

The quintessential landscape of California is oak woodland. Oaks are the central features of the landscape that most Californians identify with. Yet, California's oak woodlands are imperiled in many ways. Moreover, the forces that put California's oaks at risk endanger the birds and other wildlife dependent upon them.



Blue Oak Woodland

photo by Sandy Scoggin, PRBO

Oaks in Peril

The conservation concerns outlined here for oak woodlands, particularly the consequences of Sudden Oak Death, the lack of regeneration of several oak species, and the loss of oak habitat to development seem to be harbingers of the future for all the wildlife of California's oak woodlands.

Birds and Oaks

The birds of California’s oak woodlands are connected to this distinctive habitat mainly through acorns, the fruits of oaks that are eaten and stored by dozens of species. This ecological relationship is reciprocal: species like Western Scrub-Jays, Steller’s Jays, and Yellow-billed Magpies do not completely retrieve cached acorns and thus act as dispersers of oak seedlings across the landscape. In crucial ways, oaks provide key food for many birds, and some birds provide seed dispersal for oaks. Large oak trees also provide cavities for cavity-dependent nesting birds and other wildlife, as well as caching sites for acorn woodpeckers, nuthatches, and other species. Additionally, oaks commonly host mistletoe, which is an important food for Western Bluebirds, Phainopepla, and other species. The ties between oaks and birds are profound and diverse.



Coast Live Oak

photo by Rich Stallcup

As is true for most natural landscapes, the loss of oak woodland habitat continues as our ever-growing population converts ranches into suburbia, foothills into vineyard, and forest into prime real estate. Further, the lack of recruitment of new oaks in many species represents a crisis in the making, but one that is not currently widely acknowledged. Nonetheless, our existing oak woodlands are frequently not regenerating new oaks to replace the old ones. Finally, a new threat dubbed “Sudden Oak Death,” or SOD, is killing coastal oaks and tanoaks. This new pathogen represents a very urgent crisis indeed. The majority of California’s oak tree species are affected either by lack of regeneration or SOD, or both (Table 4-1).

Partners in Flight

This Oak Woodland Bird Conservation Plan is part of a series of California Partners in Flight (CalPIF) Bird Conservation Plans. Bird scientists and ecologists working in oak woodlands have attempted to bring an understanding of these threats to California’s oak woodlands and to discern how these issues are affecting and will affect the birds that are an integral part of these ecosystems. Perhaps unlike other CalPIF Conservation Plans, the primary focus here is on habitat problems over the immediate problems of the birds that inhabit them, but like other plans, conservation solutions are generally habitat based.

The Oak Woodland Bird Conservation Plan is an outgrowth of the national movement known as Partners in Flight (PIF). It is a plan produced by California Partners in Flight. CalPIF was formed in 1992 with the full participation of state, federal, and private land managers, scientists, and researchers interested in the conservation of nongame landbirds. Recognizing that the major cause of population declines in California was due to habitat loss, CalPIF began identifying critical habitats important to birds. The first effort was on riparian

habitat (see the “Riparian Bird Conservation Plan”, PRBO website www.prbo.org for current information).

Objective of the Oak Woodland Bird Conservation Plan

The objective of the Oak Woodland Bird Conservation Plan is to promote conservation and restoration of oak woodland habitat in California to support the long-term viability and recovery of native bird populations and the associated natural diversity tied to oak woodlands. The main goals of our endeavor are to:

- Present an overview of the conservation implications of three key problems facing California’s oak woodlands: the long-term lack of recruitment of many species of oaks and the recent pathogen (*Phytophthora* sp.) threat to tanoaks, coast live oak, interior live oak, and black oak (Sudden Oak Death), and the loss of oak woodland habitats.
- Collect data and analyze existing scientific information to help inform land managers, planners, and the public of the complex and interrelated issues affecting California’s oak woodlands and their management.
- Provide technical support for private landowners, land managers (state, federal, and non-profit), funders, agencies, and conservation organizations for assisting in the selection, management design, and implementation of the highest priority conservation/land management projects and activities.
- Support and inform efforts to increase the quantity (acreage) and quality (ecosystem function; i.e., facilitate the regeneration of oaks and restoration of native perennial grasses) of oak woodland habitat in California by identifying and promoting on-the-ground conservation activities and projects (ones that are demonstrating success in habitat restoration and recruitment).



Chapter 2. Oak Woodland Habitats in California

Geologic History of Oak Woodlands

Oaks appeared in southwestern North America, including California, beginning in the Eocene (ca. 50+ million years before present) (Axelrod 1988). The history of oaks and oak woodlands in geologic time in California is a complicated one of community assembly and disassembly with the vicissitudes of climate change. In general, oaks increase in prominence in warmer, drier conditions, and decline in cooler, wetter conditions (Axelrod 1988). By the Miocene (ca. 24 million years before present) many of California's present oak species were evident (e.g., tanoak, coast live oak, interior live oak, blue oak, and valley oak).

Finer-scale fluctuations in oak abundance and distribution are evident in the Holocene (from 10,000 years ago to the present), as shown in pollen studies (Byrne et. al. 1991). Oaks began to reestablish themselves following the last glacial period in California. Oaks were more abundant than at present during the mid-Holocene (ca. 6,000 years ago).

Classification of Oak Woodland Types

Oaks are in the plant family Fagaceae. The members of this family include *Lithocarpus* (tanoaks, the majority of species (ca. 300) are in Asia), *Castanopsis* (now more frequently referred to as *Chrysolepis*) (the chinquapins), *Castanea* (chestnuts), and *Quercus* (oaks). All produce hardened fruits. Hardened fruit evolution in the Fagaceae and related families, the associated dispersal of such fruits by vertebrates, and a great explosion of plant diversity among such families all occurred in the Eocene (Tiffney 1986). *Lithocarpus* is considered the most plesiomorphic ("primitive") while *Quercus* is considered the most apomorphic ("advanced"), as evidenced from floral morphology (Kaul 1986).

There is a long history of classification of present vegetation in California (see review in Sawyer and Keeler-Wolf 1995). Holland (1986) identified 18 natural communities dominated by oaks in California. Six are forest communities (e.g., coast live oak riparian forest), four are chaparral communities (e.g., scrub oak chaparral), and eight are woodland and savanna communities (e.g., blue oak woodland and Oregon oak woodland).

In their own treatment of California vegetation, Sawyer and Keeler-Wolf (1995) note no fewer than 15 series of oak dominated by shrubs and 14 series of oak (and tanoak) dominated by trees; a total of 81 tree series are described in total. Among the tree series, the black oak, blue oak, coast live oak, mixed oak, Oregon white oak, tanoak, and valley oak series occur over significantly large areas of California.

Griffin (1988) noted that oak woodlands have "little floristic unity", but nonetheless partitioned oak woodlands broadly into "Foothill Woodland", "Southern Oak Woodland", "Northern Oak Woodland", and "Riparian Forest" region, with each category having several subcategories, or phases. In the Foothill type, valley oak, blue oak, and interior live oak predominate. It is in the Southern oak woodland type that we find coast live oak. Griffin's

main emphasis, however, is that oak woodland represents an “ill-defined zone of oak-dominated communities growing between open grassland and montane forest.”

Thus, for our purposes, we define oak woodlands as simply those forests or woodlands where oaks (or tanoaks) are common or predominate. We wish instead to emphasize that for wildlife, including the bird community, the key issue of oak woodlands is not so much in the detail of which oak species are present, but rather that all oaks (and tanoaks) produce acorns. Acorns are perhaps the most important food product for wildlife produced in California’s many diverse habitats.



Blue Oak Acorns

photo by Steve Zack, Wildlife Conservation Society

The diverse oak woodland types in California support a range of bird communities. For example, coastal oak forests in western California support high breeding densities of forest species, such as Dark-eyed Juncos, that are not common in oak savanna habitats further inland, although both habitats support many oak-associated species such as Oak Titmouse (Tietje and Vreeland 1997, Verner et al. 1997).

Figure 2-1. Approximate current coverage of oak woodland habitats throughout California based on the California GAP Analysis Project, 1998 and potential coverage based on Kuchler 1976. See back cover for color version of this map.

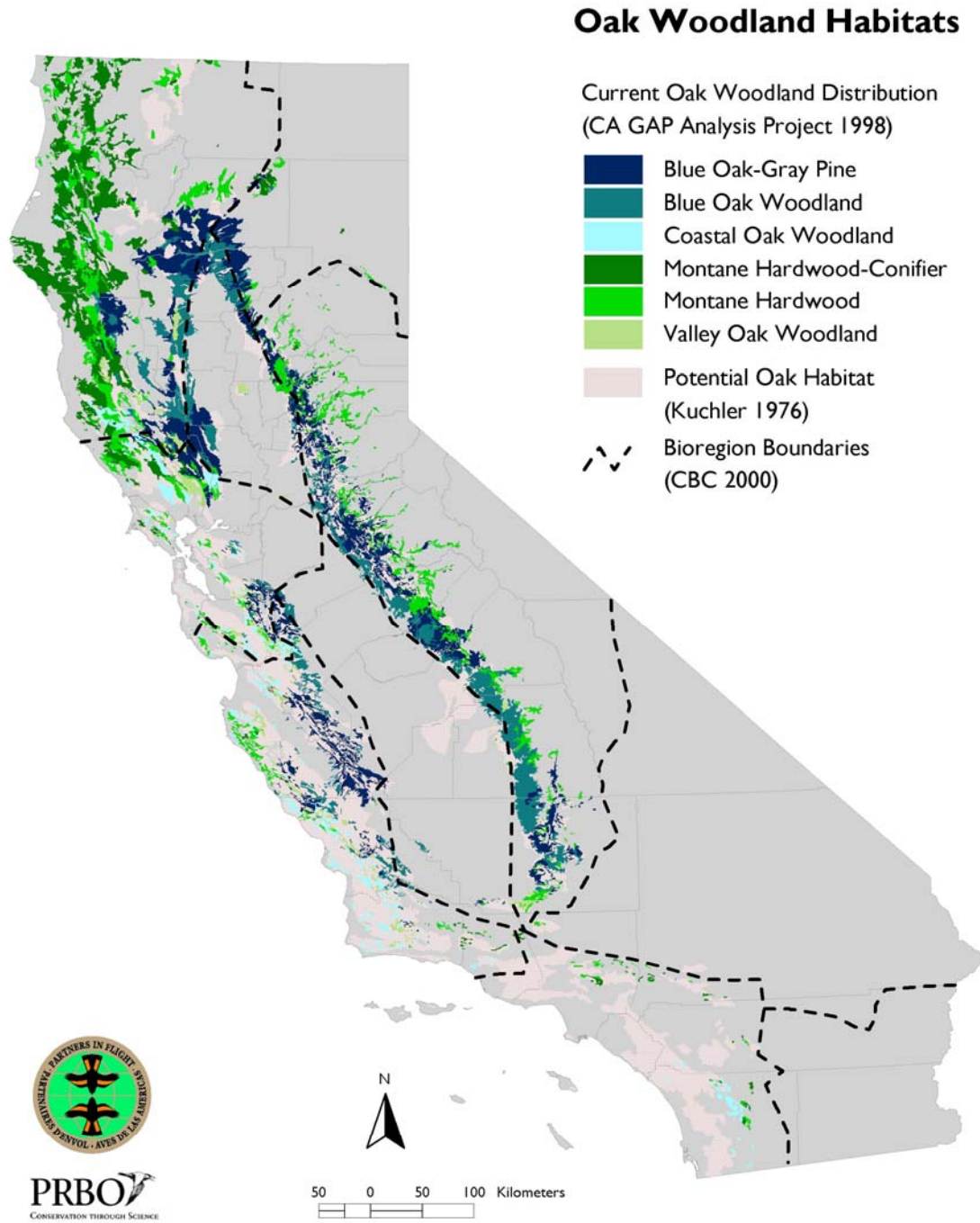


Table 2-1. Approximate current coverage of oak woodland habitat types by bioregion (in hectares) based on California GAP Analysis Project, 1998^a.

	Sacramento				
	Klamath	Modoc	Valley	Sierra	Bay/Delta
Blue Oak / Gray Pine	475,068	137,409	81,639	479,547	84,644
Blue Oak Woodland	286,506	78,650	44,781	547,501	27,581
Coastal Oak Woodland	40,183	0	18,896	0	119,425
Montane Hardwood / Conifer	985,011	22,315	0	23,027	68,019
Montane Hardwood	401,129	25,988	34,564	352,588	110,044
Valley Oak Woodland	64,531	0	9399	31,049	76,232
% Covered by Oak Woodland	34.8%	7.9%	12.6%	17.7%	21.3%

	San Joaquin	Central Coast	Mojave	South Coast	Colorado Desert	California Total
Blue Oak / Gray Pine	9210	215,811	3453	0	0	1,966,477
Blue Oak Woodland	23,286	131,707	2458	0	0	1,690,086
Coastal Oak Woodland	0	153,465	0	40,561	262	372,830
Montane Hardwood / Conifer	0	17,477	0	19,209	341	1,158,540
Montane Hardwood	1322	59,469	2793	16,580	1108	1,358,275
Valley Oak Woodland	1653	72,728	657	0	0	287323
% Covered by Oak Woodland	1.3%	21.8%	0.1%	2.9%	0.1%	13.2%

^a Davis et al. (1998)



Chapter 3. Conservation Planning Process

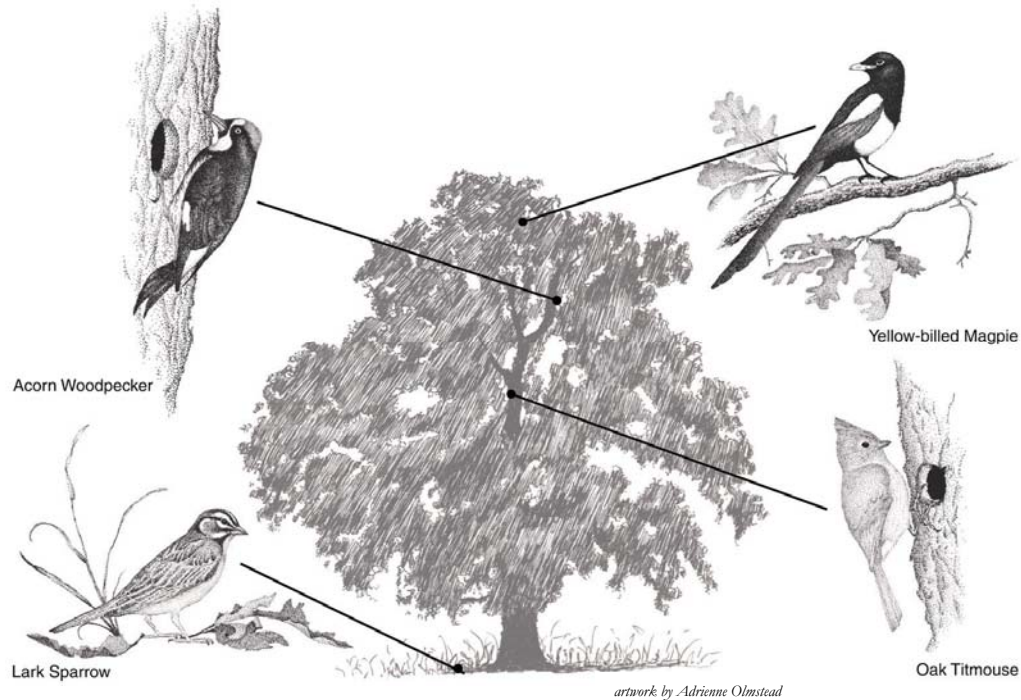
Oak woodlands are thought to have the richest wildlife species abundance of any habitat in California, as some 331 species depend on this habitat to varying degrees (Verner 1980; Barrett 1980; Block and Morrison 1998). The key connection between much of the wildlife and oak woodlands is through the oak's production of acorns. Acorn production varies in time and space between and among species (Sork and Bramble 1993; Healy et al. 1999), including species in California (Koenig et al. 1994). So-called "mast" years in oaks, when acorn production is copious in an area, are critical to triggering pulses in vertebrate populations and reproduction (Koenig 1990; Ostfeld et al. 1996; McShea and Schwede 1993; and McShea 2000). Forests with at least some oaks have higher mean vertebrate diversity than similar forests without oaks (Rosenstock 1998). This difference is due both to acorn production and the increased cavity-nesting sites afforded by large oak trees in the landscape.

Importance of Oak Habitats for Wildlife

Large oak trees in oak woodland habitats are important for cover, nesting sites for cup nesting species and cavity nesting species, as well as caching sites for birds storing acorns. In oak woodlands with large oaks, the abundance of cavity nests is important to many species of wildlife, including birds (Waters 1988; Purcell 1995). Old, large oak trees are mosaics of living and dead branches, providing ample sites for woodpeckers to excavate cavities. Dead branches and trunks in both living and dead large oaks are critically important for storage sites of acorns by Acorn Woodpeckers (Gutierrez and Koenig 1978).

There are a few studies of bird communities in California's oak woodlands (Block 1989; Block et al. 1990; Tietje et al. 1997; Verner et al. 1997; Sisk et al. 1997). These studies indicate many of the ecological connections between oak woodlands and birds. They make clear the strong link between the bird community and the production of oaks (through acorn dispersal), the importance of cavity nests in large trees, and the often complex interactions and connections between habitat features and bird species.

Fragmentation studies and efforts to identify minimal size and shape requirements of oak woodland habitat are few but important (see for example Aigner et al. 1998, Merenlender et al. 1998, Stralberg and Williams, 2002). Land managers need to know tradeoffs in habitat size and the consequences for wildlife. Restoration efforts can also be guided by knowing how many species might be present with what effort of scale.



Birds in Oak Woodlands

This schematic shows nest placement for four of the plan's focal species. Studies show a strong link between the bird community and the production of oaks (through acorn dispersal), the importance of cavity nests in large trees, and the often complex interactions and connections between habitat features and bird species.

Focal Species

Because birds occupy a wide diversity of ecological niches, they serve as useful tools in the design of conservation efforts (Martin 1995, Askins 2000). Birds are relatively easy to monitor in comparison with other taxa and can serve as "focal species", whose requirements define different spatial attributes, habitat characteristics and management regimes representative of a healthy system. For example, the bird that requires the largest area to survive in a certain habitat will determine the minimum suitable area for that habitat type. Likewise, the requirements of non-migratory birds that disperse short distances to establish new territories will define the attributes of connecting vegetation. The species with the most demanding or exacting requirements for an ecological characteristic such as territory size determines its minimum acceptable value in an area that is protected or managed for biodiversity. Therefore, the assumption is that a landscape designed and managed to meet the focal species' needs encompasses the requirements of other species (Lambeck 1997).

Because focal species lists are explicitly based on numerous hypotheses and assumptions, the choice of focal species should be tested as part of the ongoing adaptive conservation planning process. Thus, this oak woodland focal list may be revised in the future to include new species identified by research and monitoring.

Twenty-two bird species were selected by consensus as “focal species” for preparing the Oak Woodland Bird Conservation Plan. The focal species list for oak woodlands includes both a suite of species representing various habitat elements and ecological characteristics and a number of species that are good indicators for monitoring (species that are common and respond strongly and/or consistently to habitat attributes). Unlike the Riparian Bird Conservation Plan, none of the “focal species” have any special status designations. Species accounts have been prepared, or are in process, for the following bird species:

Focal Species and Species Account Authors:

- **Acorn Woodpecker** (*Melanerpes formicivorus*) by Corrina Lu and Colin Lee, California Partners In Flight
- **Blue-gray Gnatcatcher** (*Polioptila caerulea*), by Diana Humple, Point Reyes Bird Observatory
- **Western Scrub-Jay** (*Aphelocoma californica*) by Sue Guers, Point Reyes Bird Observatory
- **Yellow-billed Magpie** (*Pica nuttalli*) by Mark Reynolds, Ph.D., College of Sciences, San Diego State University
- **Oak Titmouse** (*Baeolophus inornatus*) by Moe Flannery, Point Reyes Bird Observatory
- **Western Bluebird** (*Sialia mexicana*) by Mike Lynes, Point Reyes Bird Observatory
- **Lark Sparrow** (*Chondestes grammacus*) by Diana Humple, Point Reyes Bird Observatory

Additional focal species of similar conservation concern have been identified, but species accounts have not yet been completed for these species. We anticipate and encourage future accounts for these species.

Additional Focal Species:

- **Wood Duck** (*Aix sponsa*)
- **Red-shouldered Hawk** (*Buteo lineatus*)
- **Wild Turkey** (*Meleagris gallopavo*)
- **California Quail** (*Callipepla californica*)
- **Band-tailed Pigeon** (*Columba fasciata*)
- **Northern Pygmy Owl** (*Glaucidium gnoma*)
- **Lewis Woodpecker** (*Melanerpes lewis*)
- **Nuttall’s Woodpecker** (*Picoides nuttalli*)
- **Ash-throated Flycatcher** (*Myiarchus cinerascens*)

- **Hutton's Vireo (*Vireo huttoni*)**
- **White-breasted Nuthatch (*Sitta carolinensis*)**
- **Bewick's Wren (*Thryomanes bewickii*)**
- **California Thrasher (*Toxostoma redivivum*)**
- **European Starling (*Sturnus vulgaris*)**
- **California Towhee (*Pipilo crissalis*)**

Ecological Relationships

The birds on our lists represent diverse ecological relationships with California's oak woodlands (Tables 3-1 and 3-2). Many of the bird species consume acorns. Clearly, species like Acorn Woodpeckers (Koenig 1990), Western Scrub-Jay and Oak Titmouse are highly dependent on

acorns. Verner (1980) names 30 bird species as consumers of acorns, six of which have diets that are more than 25% acorns.

Acorn Woodpeckers and Western Scrub-Jays cache (store) many thousands of acorns annually.

Western Scrub-Jay individuals may store as many as 5,000

acorns annually (Vander Wall 1990), whereas a population of Acorn Woodpeckers may store up to 43,000 in a year (Koenig 1990; Vander Wall 1990). The Western Scrub-Jay, Steller's Jay (not on our lists; see Fuchs et al. 1997), and, to a lesser degree, the Yellow-billed Magpie cache acorns individually in the ground, and thus, among caching birds, are the only species to facilitate regeneration because many acorns remain unretrieved and germinate.



Western Scrub-Jay

photo by Steve Zack
Wildlife Conservation Society

Table 3-1. Birds associated with oak woodlands 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.

Species	Consumes Acorns?	Caches Acorns?	Nest ¹	Foraging Habitat in Oak Woodlands	California Endemic?
Wood Duck	Yes		2 ^o Cavity	Wooded Streams	
Red-shouldered Hawk			Platform	Woodlands	?
Wild Turkey (I ²)	Yes		Ground	Woodlands	
Band-tailed Pigeon	Yes		Platform	Woodlands	
California Quail	Yes		Ground	Woodland-shrub	
N. Pygmy Owl			2 ^o Cavity	Woodlands	
Acorn Woodpecker	Yes	Tree, many	1 ^o Cavity	Woodlands	
Lewis Woodpecker	Yes		1 ^o Cavity	Woodlands	
Nuttall's Woodpecker	Yes		1 ^o Cavity	Woodlands	YES ³
Ash-throated Flycatcher			2 ^o Cavity	Open Woodlands	
Western Scrub-Jay	Yes	Ground, many	Cup	Woodland-Scrub	
Yellow-billed Magpie	Yes	Ground, few	Cup	Woodlands	YES
Oak Titmouse	Yes	Tree, few	2 ^o Cavity	Woodlands	YES ³
White-breasted Nuthatch	Yes	Tree, few	2 ^o Cavity	Woodlands	
Bewick's Wren			2 ^o Cavity	Woodland-Scrub	
Blue-gray Gnatcatcher			Cup	Woodlands	
Western Bluebird			2 ^o Cavity	Open Woodlands	
California Thrasher			Cup	Woodland-Scrub	YES ³
European Starling (I)			2 ^o Cavity	Agriculture edge	
Hutton's Vireo			Cup	Woodlands	
California Towhee			Cup	Woodland-Scrub	YES ⁴
Lark Sparrow			Ground	Grass - Woodland	

Notes: 1. Cavity nesting species differ as to whether they excavate their own cavities (1^o cavity nester) or they take over disused nests or naturally occurring cavities (2^o cavity nester). 2. (I) denotes an introduced, nonnative species. 3. Also occurs in Baja California, Mexico. 4. Also occurs in Baja California, Mexico, and extreme southern Oregon.

Table 3-2. Essential habitat elements for focal species, based on California Wildlife habitat Relationships System Version 7.0.¹

Focal species	Acorns	Cavities	Trees	Shrub	Grass/ herb	Snags	Brush piles	Water/ Riparian
Wood Duck		X						X
California Quail			X	X	X		X	X
Red-shouldered Hawk			X	X				X
Northern Pygmy Owl		X	X			X		
Band-tailed Pigeon	X		X					
Acorn Woodpecker	X	X	X			X		X
Lewis's Woodpecker	X	X	X					
Nuttall's Woodpecker		X	X			X		
Ash-throated Flycatcher		X	X	X				
Western Scrub-Jay	X		X	X				
Yellow-billed Magpie	X		X					X
Oak Titmouse		X	X			X		
White-breasted Nuthatch	X		X			X		
Bewick's Wren		X	X	X				
Blue-gray Gnatcatcher			X	X				
California Thrasher				X				
Western Bluebird		X	X		X	X		X
Hutton's Vireo			X	X				X
Lark Sparrow					X			
California Towhee				X				X

¹ Includes selected elements classified by CWHR as “essential” or “secondarily essential”.

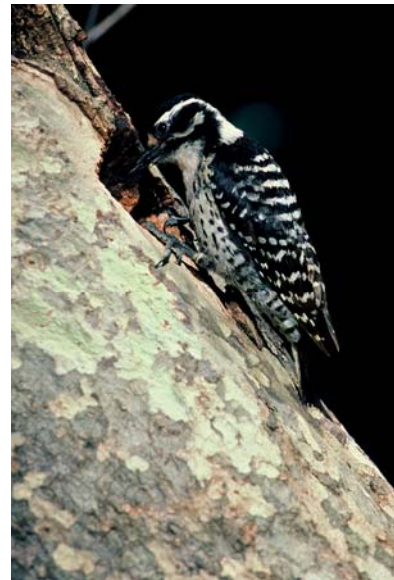
Half of the birds on our lists are cavity-nesting species. Their dependency on particularly large oak trees, with their mosaic of live and dead branches, the latter containing the cavities for nesting, cannot be overestimated (Purcell 1995). Acorn Woodpeckers are the most common cavity excavating species in oak woodland habitats, particularly the valley, blue, black and interior live oak woodlands. The secondary cavity nesting species, those that do not excavate their own cavities, typically appropriate unused woodpecker nesting cavities. Cavities can and often are used for many years, often by many species over time.



Acorn Woodpecker photo by Ian Tait

Several bird species were chosen that respond to specific types of understory habitat within oak woodlands, including Lark Sparrow, Bewick's Wren, and California Quail. The list also includes several species that are sensitive to habitat fragmentation and residential development density: Lark Sparrow and Ash-throated Flycatcher respond negatively, and Western Scrub-jay responds positively (Stralberg and Williams, 2002).

Several bird species on our lists are endemic (unique) to California, or nearly so (it is uncertain whether Red-shouldered Hawks of California are distinct from eastern hawks). And, of these, the Nuttall's Woodpecker, Yellow-billed Magpie, and Oak Titmouse are intricately tied to oak woodlands specifically. Several birds on our focal list use habitat elements such as woody debris or shrubs (Bewick's Wren, California Towhee) and others use wetland or riparian habitat elements (Red-shouldered Hawk and Wood Duck). These components of oak woodland habitats are also important to many species of mammals, amphibians and reptiles in oak woodlands.



Nuttall's Woodpecker photo by Ian Tait

Two species are non-native, and enter our list and consideration for different reasons. The Wild Turkey is an important game bird in California and an important consumer of acorns. The European Starling is included because it is a major competitor for cavities in oak woodlands. It is typically more aggressive than other species, and so prevents native cavity nesting species from accessing nesting sites. As many of our oak woodlands abut agricultural areas, they are susceptible to colonization by Starlings - an abundant pest with which our native species must contend.

Figures 3-1 through 3-7 show oak woodland distribution in California based on the California GAP Analysis (Davis 1998), current range, historic range, study sites and breeding status at these sites for the primary focal species, Acorn Woodpecker, Blue-gray Gnatcatcher, Lark Sparrow, Oak Titmouse, Western Bluebird, Western Scrub-Jay, and Yellow-billed Magpie.

Figure 3-1. PIF monitoring sites, breeding status at these sites, current and historic ranges for the Acorn Woodpecker in California. Please see www.prbo.org/calpif/maps.html for interactive color focal species maps.

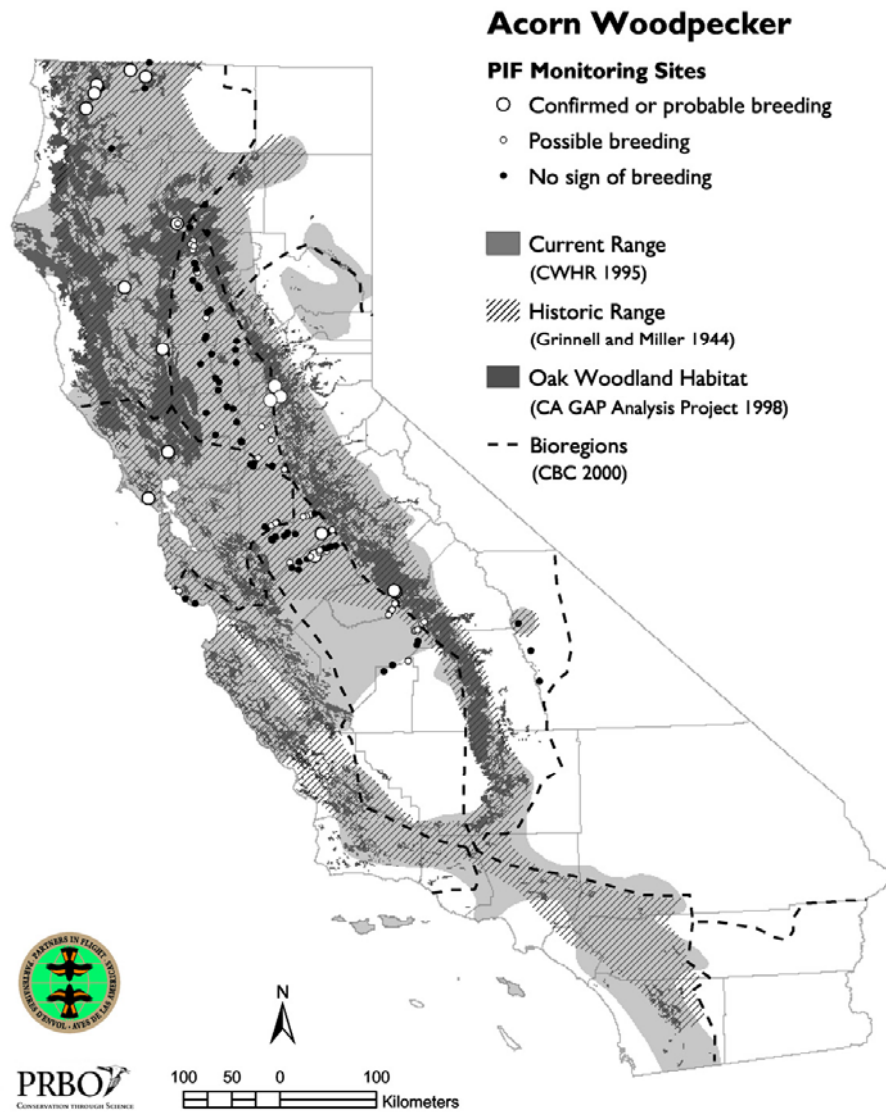


Figure 3-2. PIF monitoring sites, breeding status at these sites, current and historic ranges for the Blue-Gray Gnatcatcher in California. Please see www.prbo.org/calpif/maps.html for interactive color focal species maps.

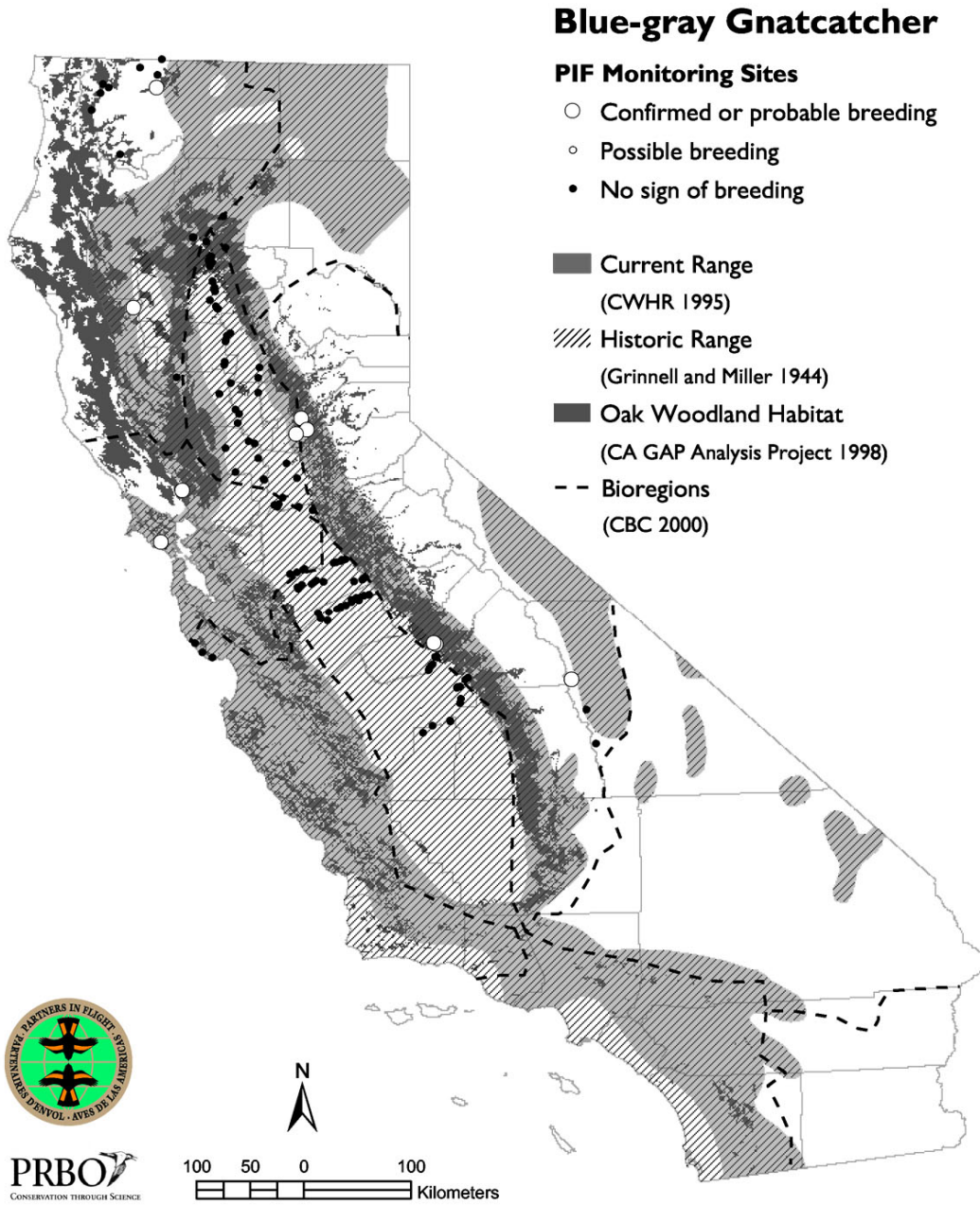


Figure 3-3. PIF monitoring sites, breeding status at these sites, current and historic ranges for the Lark Sparrow in California. Please see www.prbo.org/calpif/maps.html for interactive color focal species maps.

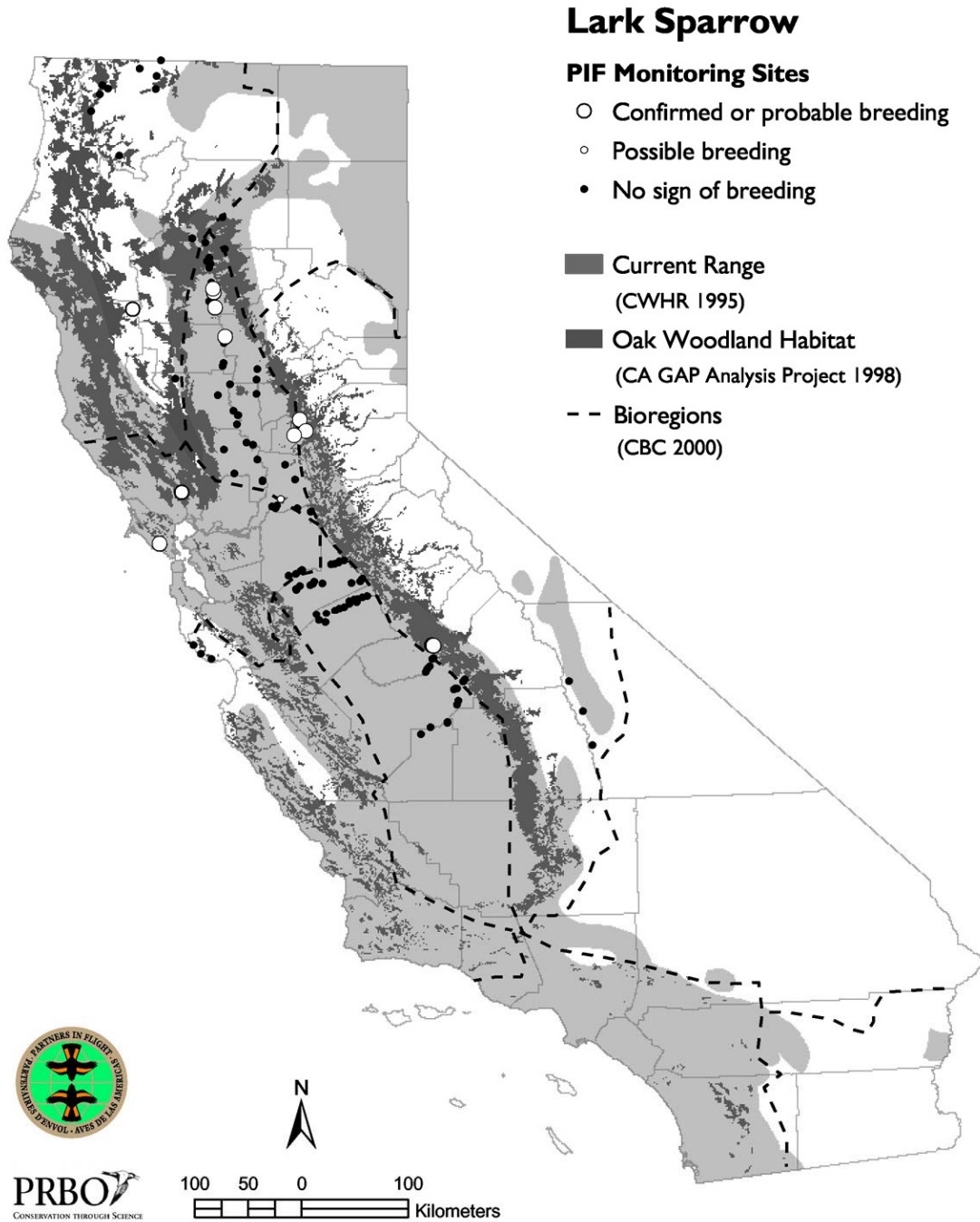


Figure 3-4. PIF monitoring sites, breeding status at these sites, current and historic ranges for the Oak Titmouse in California. Please see www.prbo.org/calpif/maps.html for interactive color focal species maps.

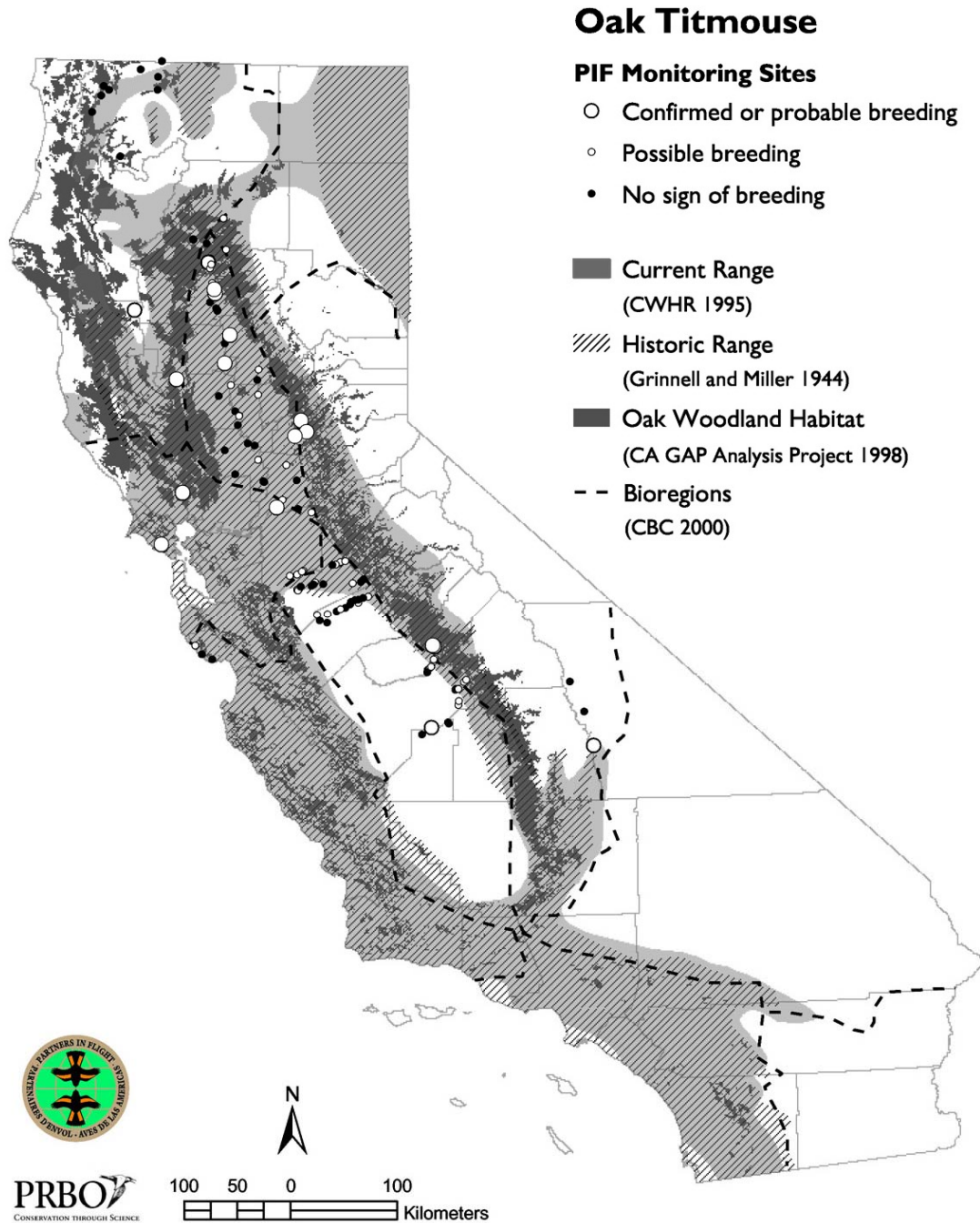


Figure 3-5. PIF monitoring sites, breeding status at these sites, current and historic ranges for the Western Bluebird in California. Please see www.prbo.org/calpif/maps.html for interactive color focal species maps.

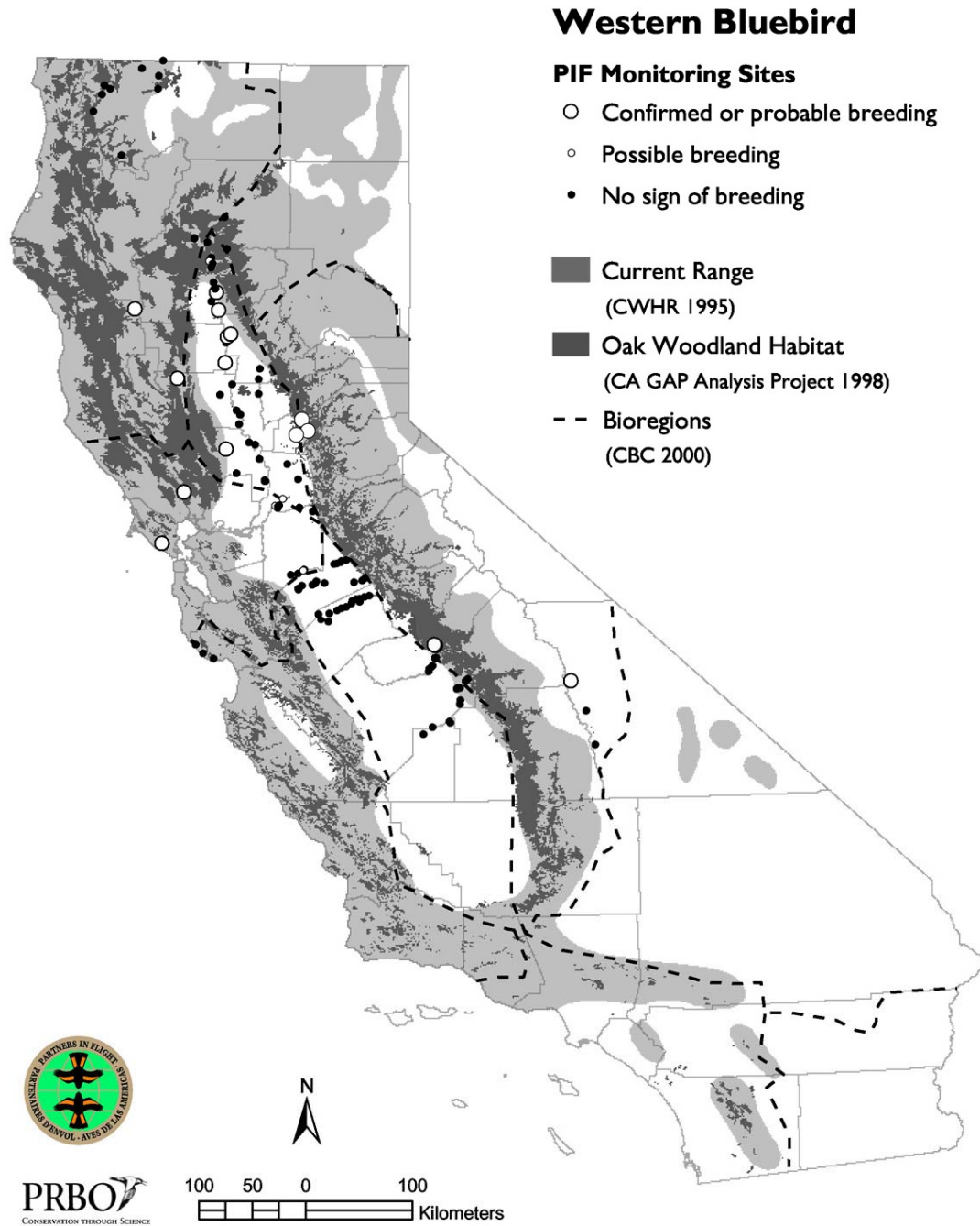


Figure 3-6. PIF monitoring sites, breeding status at these sites, current and historic ranges for the Western Scrub-Jay in California. Please see www.prbo.org/calpif/maps.html for interactive color focal species maps.

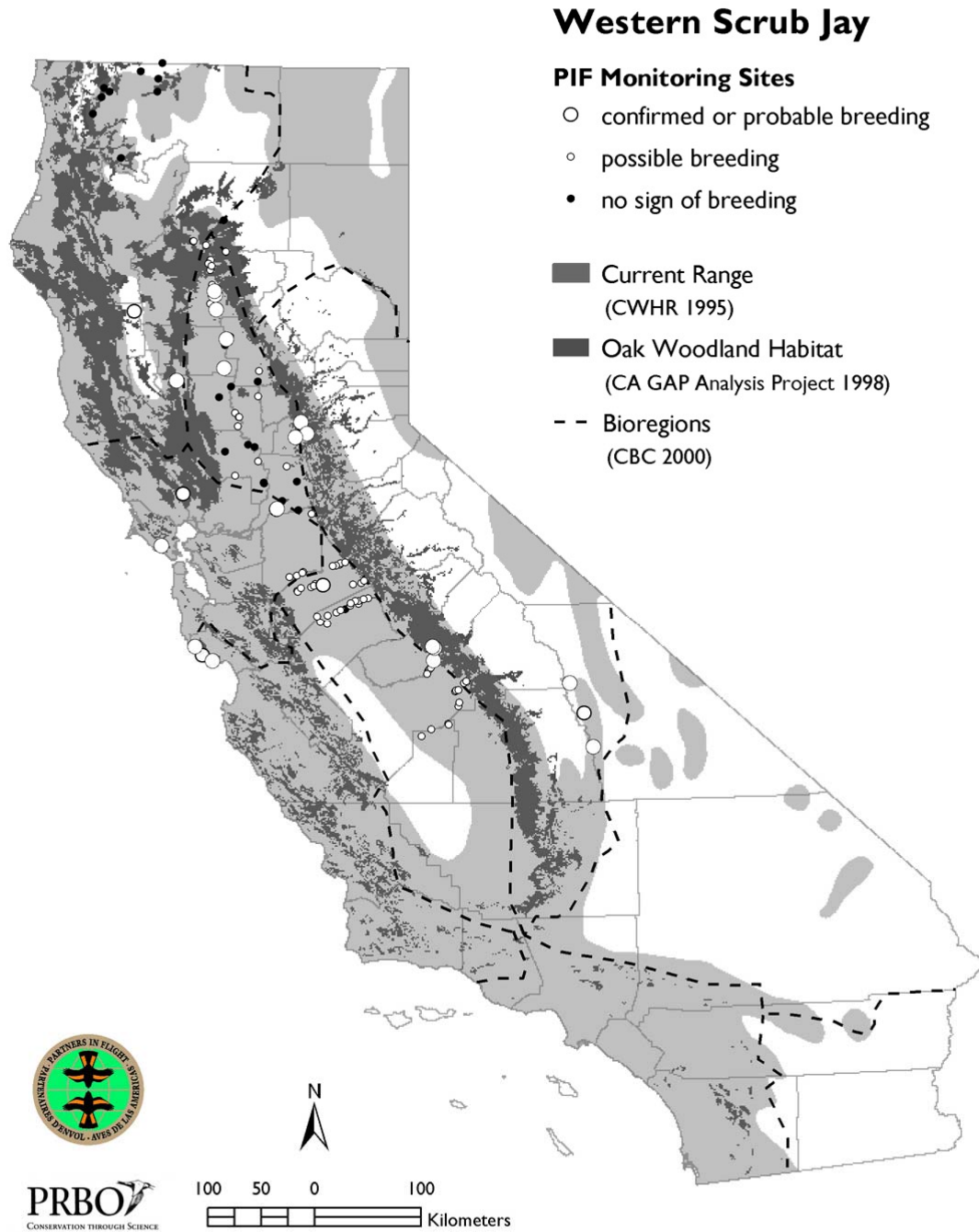
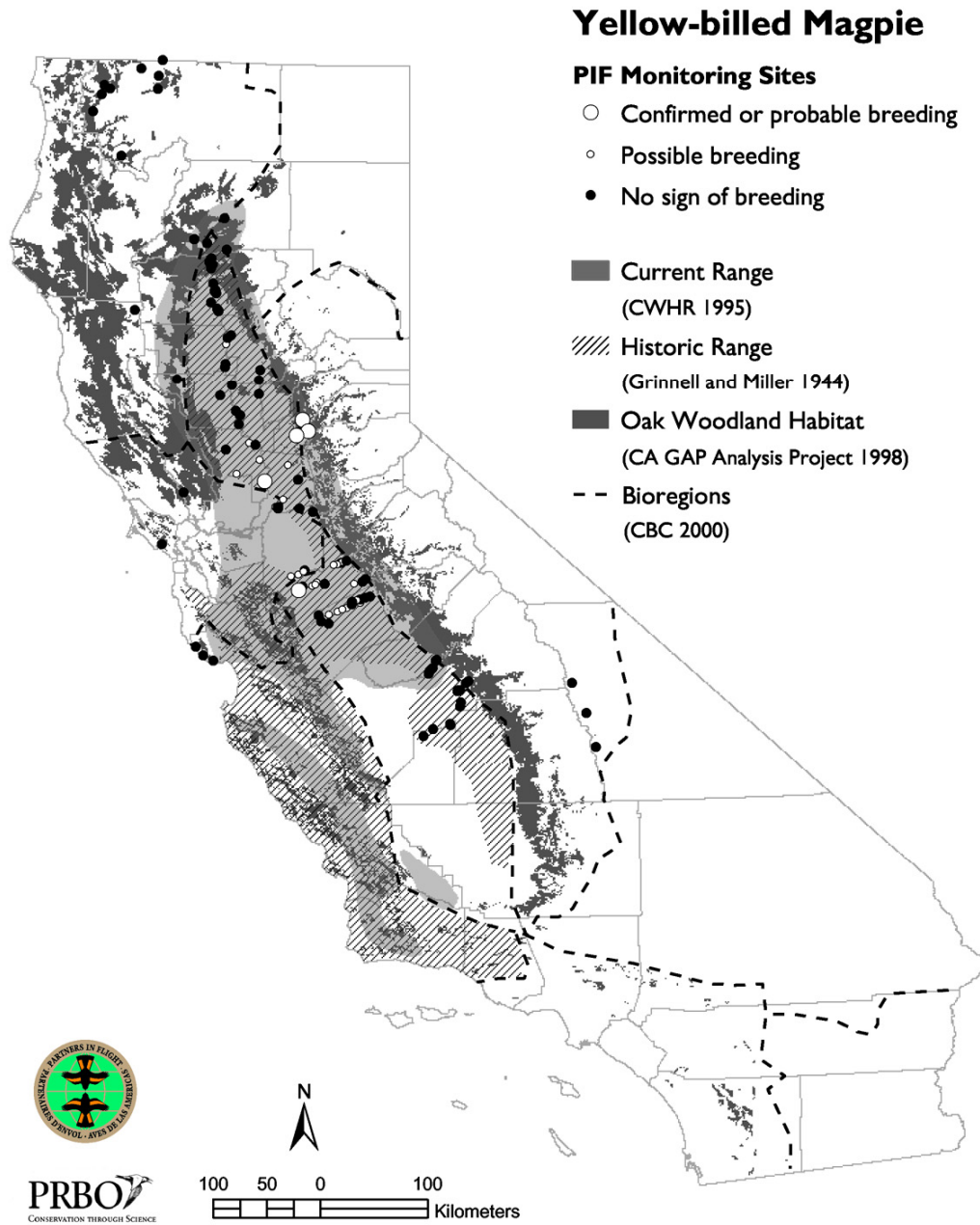


Figure 3-7. PIF monitoring sites, breeding status at these sites, current and historic ranges for the Yellow-Billed Magpie in California. Please see www.prbo.org/calpif/maps.html for interactive color focal species maps.





Chapter 4. Problems Affecting Oak Woodland Birds

Habitat Loss

More than a third of all oak woodlands have been lost since the settlement of California by Europeans; of an estimated 10-12 million acres, only some seven million remain. Of the remaining oak woodlands, most have been modified or degraded, and only about four



Yellow-billed Magpie on oak stump photo by Ian Tait

percent are formally protected (Thomas 1997). Most of the loss of oak woodlands has been due to the ever-increasing urban and suburban growth of California. The city of Oakland, the town of Thousand Oaks, and many other town names recall the former prevalence of oak woodlands, and their importance to earlier communities. The clearing of oaks has also been done on ranches to “improve” forage quantity (Bolsinger 1988), and for firewood (Bolsinger 1988; Griffin and Muick 1990; Aigner et al. 1998).

A comparatively new challenge to conservation of oak woodlands is loss to expanding vineyards. A recent example in Santa Barbara County where a prominent winery removed a small grove of oaks, causing a backlash among citizens (Van de Kamp 1996, 1997; Burns 1998a, b; Sage 1998a, b), provides evidence for the value that Californians place on their remaining woodlands and large oak trees. The accelerated clearing of oak trees in rural areas of Santa Barbara County led to the initiation of a collaborative process to develop a new oak protection ordinance (Leider in press). The wine industry is attempting to come to grips with this conflict of economic growth and the aesthetic and biological effects of oak clearing (Tobin 1999; Larson 1999). For example, the California Association of Winegrape Growers (CAWG) hosted a workshop on the interaction between wildlife and vineyards in February 2002. CAWG plans to publish a guide to wildlife-friendly vineyard management that will present case studies and resources for growers. Adina Merenlender and others from the Integrated Hardwood Range Management Program are working with vineyard owners to identify ways to manage oaks in and around vineyards (Merenlender et al, 1998).

Lack of oak regeneration

A major threat to the oak woodlands of California is that several species have experienced very little regeneration this past century (White 1966; Griffin 1971, 1976). This general problem is not unique to California (Watt 1919, for problems in Britain’s oak woodlands). The problem is not in acorn production or acorn viability, rather it is in the inability of seedlings to survive to become young trees (Borchert 1990). The causes and influences of this phenomenon are many and interconnected. It is a “cryptic” conservation crisis because it is not clearly evident as one looks across the oak woodland landscapes that surround so many of California’s population centers. The classic park-like appearance of many oak

woodlands seems intact – large trees spreading over grassy areas. But, upon closer inspection, little to no young trees are growing. In fact, in many areas, small trees are old trees of suppressed growth, not recent recruits. The consequence for several species of oaks is that existing trees will senesce, die and not be replaced unless there is active management for a different outcome.

There are several factors that contribute to this problem, and each interacts with others in ways that are often not fully understood. The factors include fire suppression, cattle grazing, invasion of European weedy annual grasses that have largely replaced native perennial grasses, and herbivory of oak shoots by cattle and native mammals.

The tree oaks known to have serious problems with lack of regeneration include valley oak (Thompson 1961), blue oak (Swiecki and Bernhardt 1998), coast live oak (Parikh and Gale 1998), and island oak (Pavlik et al. 1991) (Latin names are provided in Table 4-1). Grazing pressure is greatest where valley oak and blue oak occur. Some regeneration problems have been observed in some regions for black oak. There has been intensive research and some multiple management solutions to the recruitment problem. There is a large and diverse literature available on facilitating regeneration in oak trees, through such diverse means as seedling shelters from grazing, prescribed fire, progressive cattle management and other techniques that vary in management intensity (Adams et al. 1997; Alpert et al. 1999; Bernhardt and Swiecki 1997; Borchert 1990; Callaway 1992a,b; Gordon and Rice 1993; Griggs and Peterson 1997; Holmes 1996a, b; Jansen et al. 1997; Larsen and Johnson 1998; McCarthy 1993; McCreary and Tecklin 1997; Momen et al. 1994; Muick 1990, 1997; Parikh and Gale 1998; Phillips et al. 1997; Plumb and De Lasaux 1997; Rogers and Johnson 1998; Schwan et al. 1997; Standiford et al. 1997; Strong and George 1990; Swiecki et al. 1997a, b; Swiecki and Bernhardt 1998; Techlin et al. 1997.)

The key issue of the regeneration problem is that many diverse solutions have been identified and implemented (citations above). Management of oak recruitment can be and has been successful; the challenge is in facilitating large-scale implementation, particularly in collaborating with private landowners that collectively hold the vast majority of oak woodland habitat.

Fire and oak woodlands

Fire and oak woodlands are profoundly tied together in evolutionary and ecological ways (Reich et al. 1990; Abrams 1992; Stephens 1997). Frequent, low intensity fires gave oak woodlands in and around the Central Valley their open, park-like appearance. Frequent fires acted to thin out the understory of shrubs and small trees, and thus provide less competition for soil nutrients and water among larger, established oaks. Fire suppression arrived with European settlement. Prior to European settlement, Native Americans of California had augmented natural fire regimes by setting fires, often on an annual basis, for a variety of reasons, including to facilitate an increased acorn harvest (see Biswell 1989; McCarthy 1993). Fire suppression began in earnest in California early in the 20th century (Biswell 1989). Although California has devastating fires annually, the overall effect of fire suppression has

led to widespread changes in forest and woodland structure and function (Biswell 1989, Bonnicksen 2000).

Another effect of fire suppression on oaks is the change in vegetation structure that arises as a result. For example, fire suppression has led to an increase in incense-cedar (*Calocedrus decurrens*) and white fir (*Abies concolor*) in Yosemite National Park, which in turn has reduced the density of black oaks there (Phillips et al. 1997). In northern California, fire suppression has led to increased densities and a lower elevation occurrence of Douglas-fir (*Pseudotsuga menziesii*) at the expense of white oak, which has declined in number (Barnhart et al. 1996). This scenario is also true in the Willamette Valley of Oregon (Johannessen et al. 1971).

Over-grazing by Cattle

Over-grazing by cattle has been shown to have multiple and strong detrimental effects to ecosystems in the West (see reviews by Fleischner 1994; Belsky et al. 1999). Over-grazing has severely disrupted ecosystem structure and function generally (Fleischner 1994), and in California oak woodlands as well (Stromberg and Griffin 1996; Jackson et al. 1998; Swiecki and Bernhardt 1998). Over-grazing by cattle has directly and indirectly facilitated the invasion of weedy (European) annual grasses and the associated decline (and often loss) of native perennial grasses (Hamilton 1997). The weedy annual grasses compete for soil moisture with oak seedlings. Cattle also consume young oak shoots, as do feral pigs and native wildlife like pocket gophers and deer.

Sudden Oak Death

The newest threat to our California oaks emerged very dramatically in recent years. Tanoaks in Marin County were found to be dying in 1995 (Svihra 1999a,b,c). Soon, varied reports on tanoak death were noted elsewhere in the coastal forests of the Bay Area. In 1999, at a CalPIF meeting at Pfeiffer State Park in Big Sur, participants noticed the majority of tanoaks there were dead, conspicuous with their brown leaves still clinging to the trees. Soon, others noted that coast live oaks and black oaks near infected populations of tanoak were also showing similar symptoms and dying. The disease was christened as Sudden Oak Death Syndrome or SODS, and now is generally known simply as Sudden Oak Death or SOD.



Dead Tanoak

photo by Steve Zack
Wildlife Conservation Society

In 2000, pathologist Prof. Dave Rizzo of University of California, Davis, isolated the pathogen and discovered it to be a previously unknown species of *Phytophthora* (Standiford 2000). *Phytophthora* is a fungus-like pathogen of the same genus that caused the Irish potato famine and that has been attacking Port-Orford-cedar (*Cupressus lawsoniana*) to the risk of extinction (Hansen et al. 2000, Fimrite 2000). A *Phytophthora* species has attacked Mediterranean oaks (Brasier 1996), another species has crippled alders (*Alnus* spp) in Europe (Cech 1998), another is attacking *Eucalyptus* forests in Australia (Hansen 1999), and the genus has been a serious pest to innumerable agricultural crops worldwide (Erwin and Ribeiro 1996).



Sapwood bleeding

photo by Steve Zack,
Wildlife Conservation Soc.

The *Phytophthora* attacking California's oaks results in very distinctive symptoms. The symptoms include dark discolored patches of bark on the lower trunk, often exuding a reddish sap ("sap bleeding"), the presence of fruiting bodies of the fungus *Hypoxyylon* sp., and the frass of bark and ambrosia beetles (*Coleoptera: scolytidae*). The leaves turn brown quickly (Svihra 1999a,b,c; Standiford 2000). This particular *Phytophthora*'s DNA does not match any known species, raising the possibility of it being a new pathogen through interspecific hybridization (see Brasier et al. 1999) or a new mutant form of an existing or introduced pathogen. Different *Phytophthora* spp. have been isolated from diseased oaks in California before this problem (Raabe 1990), but they have not caused anything near the widespread infestation and death that this new pathogen has. Brasier (1996) argues that global warming enhances the oak decline in southern Europe, caused by *Phytophthora cinnamomi*.

To date, valley oaks, blue oaks, and Oregon oaks show no symptoms of SOD. Thus, it seems possible that only those oaks in the "Red" group, plus *Lithocarpus* tanoaks, (Tucker 1980) are susceptible, while those of the "White" Group are immune (Table 4-1).

Phytophthora species are oomycetes and now placed in their own Kingdom, Chromista, with another genus (Erwin and Ribeiro 1996), and are no longer considered true fungi because of their distinctive flagella and DNA. Their zoospores are mobile in moist soil and water, which can become resting spores (oospores and chlamydospores) in drier conditions. In the case of *P. lateralis*, the agent killing Port-Orford-cedar, the spores are easily transported by vehicles between watershed on the mud of tires, and by wildlife and cattle, as well as hikers and others in the woods.

During the summer of 2000, a research team sponsored by the *Wildlife Conservation Society* investigated the geography of the SOD epidemic. *WCS* surveyed the range of tanoak for the presence or absence of symptoms. The native range of tanoak runs along coastal forests in southern Oregon, down through coastal California to just north of Santa Barbara, with isolated populations in the Klamath Mountains and in the Sierras (Tappeiner et al. 1990). The team combined roadside surveys with plot samples. Preliminary results indicated that the disease was evident over some 350 miles of California coastal forest. Subsequent pathology studies have indicated that a different *Phytophthora*, *P. illipsis*, may be responsible for symptomatic trees in northern California. Then, the northern boundary of symptomatic trees was at Humboldt Redwoods State Park, just south of Eureka, and symptomatic trees of all three species were found in regular patches along coastal forests to the Santa Lucia Range north of San Simeon (Steve Zack, unpublished data.). Currently (April 2002), the disease has spread to southern Oregon (although very local and patchy there) and to the Sierras (detected in Bigleaf Maples, but not yet in tanoaks or oaks there) (see the website www.suddenoakdeath.org for updates on range and species affected by the pathogen). Preliminary results from 2000 also reveal considerable regional variation in the extent of the disease. In northern California, approximately 10 percent of the tanoaks had disease symptoms, whereas in Big Sur (Pfeiffer State Park) nearly 90 percent were dead or diseased.



Dead Coast Live Oak – Felton, California

photo by Steve Zack, Wildlife Conservation Society

Other areas particularly hard hit (ca. 40-45% of trees were symptomatic or dead) are tanoaks at Muir Woods National Monument, coast live oaks at China Camp State Park (near San Rafael), and tanoaks at Henry Cowell Redwoods State Park (in Felton). It is clear that this pathogen has spread very quickly, perhaps more quickly than other tree epidemics known in North America (Little 1995). It is not all clear if the disease is still spreading as quickly as in the late 90's or if healthy trees in infected areas are immune. Unfortunately, it seems reasonable to guess that the disease would continue to spread north, as it seems to have spread very far very fast. It would also seem that the percentage of infected trees will likely grow such that northern infected populations may become more similar to those around Marin County and at Big Sur.

The effect on wildlife of this die-off of tanoaks and oaks in coastal California is inestimable. With nearly 90% of tanoaks dead in Pfeiffer State Park in Big Sur, the loss of tanoaks to animals as diverse as black bear, deer, California Quail, and Steller's Jays, plus the several score of other species directly or indirectly dependent on acorns will be dramatic. The *Wildlife Conservation Society* is undertaking studies of wildlife effects of this pathogen in coastal California.

Oak Woodland Viability

The joint concerns of lack of recruitment and the new SOD epidemic dramatically affect most of the nine *Quercus* oak tree species and tanoak in California (Table 4-1). Of the ten acorn-bearing trees, seven have one or both of the problems, with black oak and coast live oak afflicted by both (Table 4-1). Solving the problem of lack of recruitment of white oaks, such as Valley oak and Blue oak, is especially important given that they appear to be unaffected by SOD, and therefore may be critical to the long-term viability of oak woodland-dependent wildlife.

The striking need for progressive management of California's oak woodlands is challenging for those concerned with oaks and wildlife. Yet, it must be recognized that 85% of oak woodlands are on private lands (Griffin and Muick 1990), and thus the capacity to manage these lands professionally and consistently varies and is challenging, to say the least. Working with private landowners is a significant challenge for conservationists (Knight 1999; Dale et al. 2000), but essential to guaranteeing a future of viable oak woodlands and wildlife in the future (Askins 2000).

Recent volumes directly concerned with the California landscape have raised concerns of oak woodland viability, particularly the recruitment problem (Barbour et al. 1993; Pavlik et al. 1991; Johnston 1994). The *Oaks of California* by Pavlik et al. (1991) is a particularly beautiful and well-designed book. Within California, a few conservation planning efforts have singled out oak woodlands, including the Nature Conservancy's ecoregional plans and the Sierra Nevada Ecosystem Project.

Surprisingly, other recent assessments of biodiversity and environmental problems make no special mention of the major problems facing California's oak woodlands, particularly the recruitment problem (Sudden Oak Death is too new). For example, a major overview of

imperiled ecosystems in the United States by Noss et al. (1995) has no significant discussion of California oaks, but cites only a 14% loss of hardwood woodlands (Bolsinger 1988), and cites the 99.9% loss of “riparian oak woodland” (those dominated by valley oak, Martin 1986). A two volume effort to assess the nation’s biological resources by the U.S. Geologic Survey (Mac et al. 1998) makes scarce mention of oak woodlands in its California section. The recent assessment of habitats and biodiversity by the *Nature Conservancy* (Stein et al. 2000) makes no particular mention of California’s oak woodlands. Likewise, a major assessment of North America produced by the *World Wildlife Fund* (Ricketts et al. 1999) emphasizes much of California’s distinctive endemic diversity, but again makes no particular mention of California’s oak woodlands.

Less attention may be given to oak woodlands than to other habitats, such as riparian or coastal sage scrub, which are inhabited by numerous species of special concern. However, oak woodlands are especially well-loved and support a large diversity of animal and plant species. Clearly, the issue of oak woodland viability still needs considerably more recognition before it can be adequately addressed.



photo by Steve Zack, Wildlife Conservation Society

Table 4-1. The Oak Trees (and Tanoak) of California and the presence/absence of conservation problems discussed in the text.

Common Name	Latin Name	Group ¹	General Distribution in California ²	Recruitment Problems? ³	Infected by SOD? ⁴
Tanoak	<i>Lithocarpus densiflorus</i>	--	Coastal forests, spotty in Klamaths and Sierras		Yes
Black Oak	<i>Quercus kelloggii</i>	Red	Northern foothills	Occasional	Yes
Blue Oak	<i>Quercus douglasii</i>	White	Central Valley foothills, dry coastal	Yes	
Canyon Oak	<i>Quercus chrysolepis</i>	Interm.	Foothills throughout state		
Coast Live Oak	<i>Quercus agrifolia</i>	Red	Central, southern coastal forests	Yes	Yes
Engelmann Oak	<i>Quercus engelmannii</i>	White	Extreme southern, coastal CA		
Interior Live Oak	<i>Quercus wislizenii</i>	Red	More interior foothills		Yes
Island Oak	<i>Quercus tomentella</i>	Interm.	Channel, Guadalupe Islands	Yes	
Oregon Oak	<i>Quercus garryana</i>	White	N CA (coastal and Klamaths), spotty along Sierras		
Valley Oak	<i>Quercus lobata</i>	White	Central Valley, dry coastal	Yes	

Notes:

1. Taxonomic group (from Tucker 1980: Red oaks are those with pointed lobes and densely hairy inner shells of acorns, among other characteristics; White oaks have round lobes and smooth inner shells of acorns, among other characteristics; Intermediate oaks (Interm.) are just that with respect to characters.)
2. The general distribution was described from range maps of *Lithocarpus* from Tappeiner et al. 1990, and of *Quercus* in Pavlik et al. 1991.
3. If recruitment (regeneration) is problematic for oaks, as noted by studies from the literature, a “Yes” or “Occasional” is entered in the column.
4. If oaks have been observed to have symptoms of the new *Phytophthora* infection (Sudden Oak Death), a “Yes” is entered in the column.



Chapter 5. Species-Specific Recommendations and Population Targets

The birds of California's oak woodlands share many of the same needs and threats. Large-scale conversion due to urbanization and expanding industrial agriculture continues to rapidly reduce available habitat. Human encroachment subsidizes nest predators such as raccoons, rats, and skunks and introduces exotic species of plants and animals, including domestic cats, European Starlings, and House Sparrows. These invasive bird species often out-compete native cavity-nesting birds resulting in reproductive failure and outright extirpation of local breeding birds. Finally, the apparent problem of oak regeneration threatens the future generations of all birds reliant on oaks.

Species-Specific Recommendations

In preparation for this conservation plan, CalPIF developed a series of species accounts on a suite of oak-associated bird species in California. Species were chosen because they represented niches and particular habitat needs, with the rationale that they represented other species with similar requirements. These detailed accounts described historical and current ranges, life history traits, habitat needs, and management concerns for each species. The accounts are available as electronic appendices to this plan at <http://www.prbo.org/calpif/>. Below are recommendations, derived from these accounts, for five of the focal species.

Although CalPIF strongly endorses the concept of multiple-species management, it recognizes that the needs of select focal and secondary species, representative of the different aspects of California's oak woodlands, may need to be specifically addressed. It also recognizes that managing for the specific requirements of some species is likely to affect, in either positive or negative ways, other species in the community. The challenge is that conservation actions must attempt to benefit multiple species while simultaneously tailoring their management activities for birds with very specific requirements.

One of the consistent issues raised with oak-associated birds is the need for further research into their habitat needs and management concerns. These recommendations need to be implemented, monitored, and altered as necessary. As this plan is a "living document," so are these recommendations. With future research, management decisions can be made that best benefit both the birds and humans using oak woodlands.

Lark Sparrow (*Chondestes grammacus*)

Population:

One of California's most beautiful sparrows, the Lark Sparrow often frequents open woodlands and grasslands. It usually nests on the ground, though it makes frequent use of available shrubs for perching and foraging. Overall in North America, its population appears reduced since 1968, and some data indicate decline in California's oak-dominated foothill region and in grasslands (Sauer et al. 2000). Local extirpations may be due to habitat loss and other problems of human encroachment. Still, the Lark Sparrow continues to occupy much of its historic range.



Lark Sparrow artwork by Adrienne Olmstead

Management:

Fire Management:

Managed burns that reduce the vegetative density of an area may encourage habitation by Lark Sparrows. However extremely hot fires may reduce potential nest sites and kill the native plant communities upon which this species relies. Fire suppression may allow the growth of overly dense habitat unsuitable to Lark Sparrows.

Brown-headed Cowbird Parasitism:

Lark Sparrows frequently host Brown-headed Cowbirds and suffer reduced productivity. Efforts to manage for cowbirds would likely benefit this species.

Pesticides:

Insects compose nearly 25% of the food matter consumed by this species. This species is known to nest in active agricultural areas, including row crops and orchards. Pesticide application in these areas may reduce prey availability and have other deleterious affects. More study in this area is needed.

Invasion of Exotic Vegetation:

In some areas, Lark Sparrows no longer breed where native vegetation has been replaced by invasive exotic grasses. Along with many other plants and animals, they would benefit from efforts to control exotics and restore native vegetation.

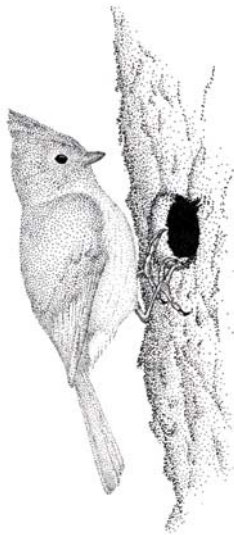
Disturbance:

Because they prefer to nest on the ground, Lark Sparrows are particularly vulnerable to such disturbance as grazing, off-trail recreation, burning, and mowing. Their nests are also

exposed more readily to predators such as domestic cats, raccoons, and dogs. Managers should take steps to limit this kind of disturbance during the breeding season (March through August).

Research Needs:

The Lark Sparrow's preference for edge habitats may have excluded it from many research and monitoring efforts. Few studies have focused on this species and its low densities render broad studies less effective. More studies on this species' life history, current range, and habitat requirements are needed.



Oak Titmouse
artwork by Adrienne Olmstead

Oak Titmouse (*Baeolophus inornatus*)

Population:

Given its name, it's no surprise that this species populates many of California's oak and oak-pine woodlands. Usually preferring areas of moderate canopy cover, they nest in natural cavities or holes previously excavated by woodpeckers. While the species continues to appear in every bioregion with oaks in the state, Breeding Bird Surveys indicate a significant decline in California since 1980.

While the Oak Titmouse readily nests near human settlement, and can often seem fearless when faced with human observers, it suffers from the human related invasion of nest-competitors such as European Starlings and House Sparrows.

Management:

Canopy Cover:

The Oak Titmouse prefers woodlands with a canopy cover between 40-70%. Thinning of trees for lumber or firewood cutting may render habitat unsuitable. Land owners and managers should be encouraged to maintain stands with sufficient canopy cover for this species.

Acorn Woodpecker (*Melanerpes formicivorus*)

Population:

Of all the birds that rely upon California's oaks, the Acorn Woodpecker is the one most intimately linked to the habitat. With its distinctive clown-like face and "waka-waka" calls, it is easily detectable by most observers and hard to forget once seen. Acorn Woodpeckers breed cooperatively throughout the oak woodlands and oak-pine hillsides of California. They usually live in family groups of 2-15 individuals and cluster around a few granary trees, in which they store acorns. They readily appear on Christmas Bird Counts and Breeding Bird Surveys and can be found both near to and away from human settlements and other disturbance.

The geographic distribution and density of Acorn Woodpeckers in California are significantly correlated with oak species diversity (Bock and Bock 1974, Koenig and Haydock 1999). Reproductive success and population size appear regulated by granary tree availability and the amount of acorns stored during the preceding autumn (Trail 1980; Koenig and Mumme 1987, Stacey and Ligon 1987). Population trend estimates based on Breeding Bird Surveys are inconclusive, though local extirpations due to oak removal have probably occurred and invasion by European Starlings may also pose a threat.



Acorn Woodpecker
artwork by Adrienne Olmstead

Conservation and Management:

Acorn Harvests:

Acorn Woodpeckers actively harvest and store acorns. Family groups collect acorns and hammer them into drilled holes in granary trees on the territory. This pantry serves to supplement their diet throughout the year, particularly in the winter months when insect prey is sparse. In Arizona, where acorn crops are light, populations do not form family groups and the birds will migrate over the winter to search for food. In California, the fate of Acorn Woodpecker family groups is often closely tied to that of their local oaks; years of low acorn production are often followed by less productive breeding seasons (Trail 1980; Koenig and Mumme 1987; Stacey and Ligon 1987). A reduction in acorn availability, through an overall reduction in oaks, may endanger local populations and groups have been forced to emigrate from an area during years of poor acorn production (Hannon et al. 1987). Managers should seek to maintain large tracts of land to include a natural diversity of oak species or intraspecific oak varieties with different seeding phenologies. This will help avoid synchronous or wide geographic-scale crop failures (Koenig and Haydock 1999).

Granary Trees:

Granary trees anchor Acorn Woodpeckers to a site, providing supplemental food throughout the year. Such trees are often dead or have many dead limbs, which are easier to

bore into. The soft, dead wood is also attractive to fire-wood cutters, whose activities can reduce available habitat for the woodpeckers (Koenig et al. 1995). Managers should encourage the maintenance of all trees used as granaries (trees and limbs filled with tell-tale holes for acorns), even if they are not currently in use by an Acorn Woodpecker group. On average, Acorn Woodpecker groups maintain 2.1 granary trees per 6 ha territory (range 1-7) (MacRoberts and MacRoberts 1976). Land managers should maintain a similar high density of snags and dead tree limbs, or soft-wooded live trees such as pines or sycamores (35 granary trees/100 ha, or 1 snag every 2.86 ha). Dead tree limbs or snags from 17 cm to greater than 100 cm can be used as both a granary and nest site (Hooge 1989).

Grazing and Oak Recruitment:

Damage from cattle grazing in pine-oak woodlands and montane riparian areas may threaten some populations of Acorn Woodpeckers. While Acorn Woodpeckers are still common throughout their range, the low recruitment of new oaks on intensively grazed land will likely not sustain populations in the future. For example, a lack of potential granary trees due to poor recruitment has the potential to cause eventual population declines (Ligon and Stacey 1996).

Land Conversion:

Land conversion from oak woodland to other uses, such as residential or agricultural, can affect woodpecker populations if adequate food resources are compromised. However, Acorn Woodpeckers show a strong ability to adapt to suburban and city-park development if acorns are available. They will often use utility poles and wooden structures, such as sheds and barns, as roosts and granaries (Koenig et al. 1995).

European Starlings:

Starlings often out-compete many native birds for nest cavities. While Acorn Woodpeckers will successfully defend an initiated nest, they usually fail to do so for cavities invaded before nest initiation or egg laying. Starlings are most common near human settlements and their presence can signal of habitat fragmentation. Large tracts of land, away from disturbance, should be maintained whenever possible to discourage invasion of Acorn Woodpecker territories.

Structural and Species Diversity:

Current population levels may rely upon a diverse age structure and species composition of oak trees (Ligon and Stacey 1996, Koenig and Haydock 1999). Managers can achieve structural and floristic heterogeneity through less intensive grazing methods, planting and protection of multiple species of oak seedlings (using 'tree-pees' etc.), and by creating optimal conditions for oak woodland regeneration.

Western Bluebird (*Sialia mexicana*)

Population:

Western Bluebirds are a common site on fence posts and low snags in oak woodlands and savannas throughout the state. They prefer fairly open areas, though they avoid clear cuts and agricultural fields. Breeding populations of Western Bluebirds appear to be declining in some regions of the state, primarily due to human development and subsequent invasion by European Starlings. Winter populations fluctuate with annual mistletoe crops, and may be excluded from areas where mistletoe, or the oaks it parasitizes, is cleared.



Western Bluebird photo by Ian Tait

Management:

Nest box Programs:

Recent efforts to expand nest box building programs may help curtail bluebird declines. Nest box programs should include a monitoring component which:

1. Ensures that boxes are being used by native species. Those that are not should be reviewed and perhaps removed to avoid use by unwanted species such as House Sparrows or European Starlings.
2. Ensures that predators are not regularly taking nestlings or killing adults.
3. Maintains boxes in good condition. For example, woodpeckers will enlarge holes that will allow predators, especially European Starlings and House Sparrows, to get into nest boxes and destroy nests.

You can find guidelines from the **North American Bluebird Society** on-line at <http://www.nabluebirdsociety.org/>.

Logging Practices:

The practice of “thinning” is less detrimental to bluebirds than “clearcutting.” This problem is particularly relevant in areas where oaks are cleared to install vineyards or conifers (for logging). Leaving at least some oaks may mitigate these losses. Bluebirds, like many cavity nesters, require older trees with naturally occurring or previously excavated cavities. Furthermore, they prefer live trees rather than ones that have completely died.

Urbanization:

This problem extends to all animals reliant on oak woodlands. Increased urbanization leads to the introduction of nest-site competitors and predators such as House Sparrows, European Starlings, and an increase of mammals associated with urban areas (such as cats, skunks, and raccoons).

Blue-gray Gnatcatcher (*Polioptila caerulea*)

Population:

Blue-gray Gnatcatchers historically bred in oaks and chaparral stands throughout most of California's bioregions. Data from the past thirty years show some declines and extirpations, possibly connected with the expansion of Brown-headed Cowbirds and the heavy parasitism gnatcatchers incur. There have been no recent surveys that adequately estimate their current breeding range. Where nests have been found, nest success is extremely low and parasitism common, a characteristic shared with other gnatcatcher species, including California and Black-tailed, signaling a need to gather more conclusive information about the California population.



Blue-gray Gnatcatcher at nest photo by Ian Tait

Management:

Brown-headed Cowbirds:

Until recently, Blue-gray Gnatcatchers appeared extirpated from San Diego County, probably due to overwhelming parasitism pressures. Conservation efforts on behalf of the Least Bell's Vireo and California Gnatcatchers may benefit Blue-gray Gnatcatchers in the region. Monitoring of the two listed species should be extended to include Blue-grays to establish whether their population is expanding with control efforts as well.

Diverse Habitat Structure:

Blue-gray Gnatcatchers prefer to nest in open scrubby areas and forage in more dense vegetation. Protected and managed habitat should maintain such diverse structure, including mosaics of oaks and shrubs.

Research and Monitoring:

Few recent data are available for Blue-gray Gnatcatchers in California. Breeding Bird Surveys and Point Counts poorly sample populations because these birds live in relatively low densities, though they are easily recognized when found. Breeding Bird Atlas data may provide valuable insight to local population changes. However, much more detailed study is needed. The few nest studies that do include Blue-gray Gnatcatchers demonstrate an extremely low nest success rate.

Population Targets

Partners in Flight seeks to develop avian population targets that will guide conservation efforts and provide land managers with a gauge of success for their restoration and management activities. Although ambiguous and hard to develop, numerical population targets provide a compelling means of communicating with the public and policy makers. In some cases, targets may simply require maintenance of populations at existing levels. However, targets for rare or declining species will encourage actions that increase existing populations to sustainable levels.

Bioregionally-based population targets for many of the primary and secondary oak woodland species have been developed using all available data (Table 5-1). These targets are simply the highest densities (either indirectly through point counts, or directly through spot mapping) found for that species within a given bioregion. These data are currently lacking from most bioregions and for many species. More data likely exist for some of these species, and contributions of data to CalPIF is encouraged for incorporation into future versions of this “living” document.

Two types of data are presented. The first is spot map data, in which the number of territories per 40 hectares is estimated based on Breeding Bird Census plots (plots are usually less than 40 hectares, but are converted for purposes of standardization). The second is point count data, in which the average number of individuals detected within 50 meters of a point count station is presented. These two types of data are not necessarily comparable to one another, nor convertible. Such reference density estimates are useful as population density targets that can translate into habitat acreage protection for some species, or be considered in restoration goals.

Table 5-1. Suggested population targets by species and bioregion¹. See Table 5-2 for a key to data sources, indicated here by superscripts ^{A-K}.

Species	Bay-Delta		South Coast		Sierra		San Joaquin		Central Coast	
	Point Count ^A	Spot Map	Point Count	Spot Map ^C	Point Count ^D	Spot Map	Point Count	Spot Map	Point Count	Spot Map
Acorn Woodpecker	0.16	-	-	-	0.56	7.0 ^E	-	-	-	6.7 ^G
Ash-throated Flycatcher	0.12	-	-	10	0.31	10.6 ^E	-	-	-	8.2 ^H
Bewick's Wren	0.46	-	-	2.5	0.23	9.2 ^F	-	-	-	23.3 ^H
Blue-gray Gnatcatcher	0.10	-	-	2.5	0.27	10.0 ^A	-	-	-	23.3 ^H
Hutton's Vireo	0.19	15.6 ^B	-	7.5	0.01	1.4 ^E	-	-	-	3.3 ^I
Lark Sparrow	-	-	-	-	0.39	0.5 ^E	-	-	-	2.3 ^I
Lewis' Woodpecker	-	-	0	0	-	- ³	?	?	-	-
Nuttall's Woodpecker	-	-	-	-	0.09	1.6 ^E	-	-	-	2.3 ^H
Oak Titmouse	0.40	15.4 ^L	-	35	1.33	26.4 ^E	-	-	-	49.4 ^I
Western Bluebird	-	-	-	-	0.38	5.0 ^A	-	-	-	8.2 ^H
Western Scrub-Jay ²	0.61	-	-	-	0.31	10.9 ^F	-	-	-	7.0 ^H
White-breasted Nuthatch	-	-	-	-	0.82	4.3 ^E	-	-	-	10.2 ^I
Yellow-billed Magpie	-	-	0	0	-	-	-	-	-	-

¹Numbers provided from point counts are the average number of detections within 50 meters ($n / \#$ points / $\#$ visits) of the observer during five minute counts during the breeding season. Point count data provide an index of abundance, generally thought to be conservative. Numbers from spot mapping are pairs per 40 hectares during the breeding season, unless otherwise noted. *Reference populations are cited and may not be representative of healthy populations.* Dashes represent no data and zeroes indicate the species probably never bred in that bioregion.

²Not an appropriate species to set population targets according to high counts/ high breeding densities, due to implications for other species.

³No Lewis' Woodpeckers have been found nesting at San Joaquin Experimental Range^{E,F} during a long-term nest searching effort, although they are abundant winter residents (K. Purcell, personal communication).

Table 5-1 (cont.).¹

Species	Klamath ³		Sacramento Valley		Modoc		Mojave		Colorado Desert	
	Point Count ¹	Spot Map	Point Count ¹	Spot Map ^K	Point Count	Spot Map	Point Count	Spot Map	Point Count	Spot Map
Acorn Woodpecker	0.04	-	0.20	3.75	-	-	0	0	0	0
Ash-throated Flycatcher	-	-	0.49	8.75	-	-	-	-	-	-
Bewick's Wren	-	-	-	12.5	-	-	-	-	-	-
Blue-gray Gnatcatcher	0.16	-	-	2.5	-	-	-	-	-	-
Hutton's Vireo	-	-	-	-	-	-	0	0	0	0
Lark Sparrow	0.15	-	0.03	-	-	-	-	-	0	0
Lewis' Woodpecker	-	-	?	?	-	-	0	0	0	0
Nuttall's Woodpecker	-	-	0.12	5	-	-	-	-	0	0
Oak Titmouse	0.19	-	1.5	20	-	-	0	0	0	0
Western Bluebird	0.10	-	-	-	-	-	-	-	?	?
Western Scrub-Jay ²	0.03	-	0.65	5	-	-	-	-	?	?
White-breasted Nuthatch	0.10	-	0.33	-	-	-	-	-	-	-
Yellow-billed Magpie	0	0	-	-	0	0	0	0	0	0

¹Numbers provided from point counts are the average number of detections within 50 meters (n / points / # visits) of the observer during five minute counts during the breeding season. Point count data provide an index of abundance, generally thought to be conservative. Numbers from spot mapping are pairs per 40 hectares during the breeding season. *Reference populations are cited and may not be representative of healthy populations.* Dashes represent no data and zeroes indicate the species probably never bred in that bioregion.

²Not an appropriate species to set population targets according to high counts/ high breeding densities, due to implications for other species.

³Additional data on territory densities can be found in Wilson et al. 1991 for Mendocino County.

Table 5-2. Sources of population data in Table 5-1.

Alpha code	Data source, habitat type, location, and year.
A	PRBO unpublished data. Bay-Delta data are from Marin Co. (Holmes et al. 1998) except for Oak Titmouse, which are from the Cosumnes River Preserve, Sacramento Co. Sierra data are from Independence Creek, mixed black oak and riparian habitat (1999 for Blue-gray Gnatcatchers, 2000 for Western Bluebird).
B	Van Fleet 1919; live oak woodland.
C	May and Peters 1979; coast live and Engelmann oak woodlands, Orange Co., 1978.
D	PRBO unpublished data; Tehama Co. foothills, 2001.
E	Verner et al. 1997; grazed oak woodland, San Joaquin Experimental Range, Madera co., averaged over nine years (1985-1993).
F	Verner et al. 1997; ungrazed oak woodland, San Joaquin Experimental Range, Madera co., averaged over nine years (1985-1993).
G	MacRoberts and MacRoberts 1976; Hastings Reservation, Monterey Co., territory density based on average territory size of 6 ha (average number of adults per territory = 4.4; Koenig et al. 1995).
H	Williams 1979, 1980, Joste 1981; blue oak woodlands, Monterey Co., averaged over three years 1978-1980.
I	Tietje et al. 1997b, Camp Roberts, San Luis Obispo Co., averaged over two years (1994-1995).
J	PRBO unpublished data. Klamath data are from Brewer's Oak forests in the Mendocino National Forest, Mendocino Co (1996); Sacramento Valley data are from blue oak forests at East Park Reservoir, Colusa Co.
K	Gaines 1979; blue and interior live oak woodlands, Sutter Co.
L	Cicero 2000; San Francisco Bay region, based on average territory size of 2.6 ha.



Chapter 6. Bioregional Conservation Objectives

California has a higher biodiversity of wildlife and plants than any comparable area in the northern temperate zone (Biosystems Analysis 1994). The state also has more endemic species, particularly plants and birds, than any other state except Hawaii. This great diversity provides significant challenges in conservation planning, particularly over a state as large and geographically diverse as California.

As with the other habitat plans, we have adopted the California Biodiversity Council's 10 bioregions as a guideline for dividing the geography of California into natural communities organized by biota, climate, topography and soils (RAC 1998). See Figure 3.1 for bioregion boundaries. These contrast slightly with the 11 discrete regions recognized by Sawyer and Keeler-Wolf (1995) and Biosystems Analysis (1994).

Setting conservation goals by bioregion helps facilitate planning site-specific projects in a broader context, and provides a similar framework to other conservation planning efforts. Setting and achieving conservation goals by bioregion will:

- Ensure that a suite of ecological communities representative of California's diversity will be conserved throughout the state.
- Ensure that the broadest range of biodiversity and locally adapted races of species will be conserved.
- Facilitate action at the local level.

This section introduces each of the 10 bioregions considered in this plan. These descriptions are offered as an overview; the issues and needs may vary depending on particular sites within a bioregion. For more information on each, please consult the Resource Agency of California's *Preserving California's Natural Heritage* (RAC 1998).

For each bioregion, we list potential "Portfolio Sites", areas that are distinguished by their protected status and potential for managing oak woodland habitat through restoration. Many of these Portfolio Sites contain oak woodland habitat located near other habitats of concern. Thus, there is considerable potential for management of such areas to achieve goals for the many CalPIF habitat plans. This list is not comprehensive and will be updated as the Plan is revised. These sites have been identified by our own experience in oak woodland habitat and by drawing from the excellent volume by Pavlik et al. (1991). We ask that individuals and groups working in these bioregions bring important sites and activities to our attention.

It is important to make a distinction between our use of the term "Portfolio Site" and its use by other organizations. Most notably, The Nature Conservancy of California has identified a list of sites which are prime candidates for conservation and which are ranked in order of priority based on their biological richness and the immediacy of threats to them. Some of these sites are also considered as Portfolio Sites in this and other CalPIF Bird Conservation Plans, and more may be included in the future as they become protected and efforts to manage for oak woodland are expanded.

Sacramento Valley

The northern portion of the Central Valley, the Sacramento Valley is a region characterized by hot, dry summers, and cool, foggy winters. The great Central Valley of California is a region that has undergone considerable transformation in the past century, from a mosaic of wetlands, riparian forests and dry grasslands containing millions of waterfowl, elk, pronghorn and other wildlife (an “American Serengeti”), to a virtual agricultural machine. Nonetheless, in the uplands that surround the valley floor and in localized bottomlands there remain several areas important to oak woodland habitat. These upland areas are among the many regions in California where conversion of habitat to vineyards poses a serious threat to oak woodlands. The lowland areas include areas that are or historically were valley oak woodland and have been degraded or reduced through development, agriculture, and the damming of California's rivers.

Portfolio Sites

East Park is a Bureau of Reclamation (BOR) site of oak woodland and riparian habitat surrounding the East Park Reservoir, in the foothills of the Coast Range near the town of Maxwell. Extensive blue oak woodland is found here along with few, but large, valley oaks. BOR is interested in managing this area for wildlife. There is good potential for management beneficial to oak woodland habitat, which would be crucial for supporting recruitment in both valley and blue oaks.



East Park, Sacramento Valley Portfolio Site

photo by Geoff Geupel, PRBO

Bidwell Park has many acres for valley oak (2,250 acres) woodland in Northern California. The ownership is the City of Chico, Parks and Recreation, and it is the second largest municipal park in the country.

The Sacramento River region now includes areas under intensive restoration. Efforts are underway to re-establish valley oak (Alpert et al. 1999). Partners include the Nature Conservancy, the U.S. Fish and Wildlife Service, the California Department of Fish and Game, and the California Wildlife Conservation Board and stakeholders participating in the Sacramento River Conservation Area. This area is also a Portfolio site in the Riparian Bird Conservation Plan.

Cache Creek is an important area in northern California with large stands of both valley and blue oak. This land is administered by BLM, and has potential for restoration of recruitment and regeneration of these imperiled trees.

San Joaquin Valley

Also a major part of California's Central Valley, the San Joaquin Valley has been thoroughly transformed by intensive agriculture and development. Another industry important to the region's economy has been oil. The region is characterized by similar weather to the Sacramento Valley, including hot, dry summers and cool, foggy winters. Along with the rest of the wetlands, native grasslands and riparian vegetation, the valley oak riparian forests once characteristic of this region are almost gone (Bolsinger 1988). The water flow and habitat along the San Joaquin River itself, for instance, has been significantly diminished by the development of agriculture or mining along nearly every mile of its reach and by the construction of the Friant Dam (RHJV 2000). Nonetheless, crucial remnant pockets of valley oaks remain. Additionally, some upland areas containing oak woodland habitats exist in the foothills of the surrounding mountain ranges, including regions where conversion to wine vineyards has occurred or continues.



San Joaquin Valley

photo by Geoff Geupel, PRBO

Portfolio Sites

Kaweah Oaks Preserve has one of the last valley oak riparian forests remaining in the region. This 324-acre preserve, owned originally by The Nature Conservancy and now by the Sierra Los Tulares Land Trust, is a private wildlife sanctuary created for the purpose of protecting valley oaks and associated wildlife. Valley oak regeneration has taken place (as well as many other native vegetation changes) since cattle were removed.

Caswell Memorial State Park also protects one of the last remnant valley oak riparian forests in the San Joaquin Valley. These 258 acres located northwest of Modesto have been owned and managed by the California state parks system since the 1950's. CalPIF and other organizations have documented the high use and clear importance of this small park to birds.

Oak Grove Regional Park is the site of a cattle ranch where valley oaks were retained (Pavlik et al. 1991). Today, this 170-acre park located near the city of Stockton is managed by the San Joaquin County Department of Parks and Recreation.

Modoc

Of all the California bioregions, perhaps Modoc most resembles its historic state. It is host to the least number of human inhabitants of all ten bioregions, but continued human growth is likely as pressures increase along with California's population expansion. The landscape is characterized by extensively forested mountains, vast reaches of high desert, and volcanic uplands. Typical weather includes hot dry summers and cold, wet winters, with snow at higher altitudes. Oak woodlands are sparse and few, with black oak most common and Oregon oak also present. As in other montane habitats, changes in the fire cycle, due to fire suppression and increased fuel accumulation, has had an impact on the structure and ecology of hardwood forests in this bioregion.

Portfolio Sites

Quail Spring is identified as an area where black oak co-occurs in mixed conifer stands (Pavlik et al. 1991). It is located east of MacArthur on Highway 299 and managed by the Modoc National Forest.

Klamath

The Klamath region is home to some of the most dramatic geologic landscapes on earth. It is known for its steep, rocky shorelines, rich coniferous forests of coast redwoods and Douglas firs, extensive mountain ranges and salmon runs. No other bioregion in California receives as much rainfall, and the bioregion is characterized by cool, foggy summers along the coast and rainy winters throughout. Its high mountains create a dramatic rain shadow, resulting in stark contrast between the north coast climate and the nearby interior. Ranges in this mountainous region include the Klamath, Siskiyou, Marble, Salmon, Trinity, and Cascade Mountains, and the North Coast Range.

The bioregion is home to five national forests, the Siskiyou, Six Rivers, Klamath, Shasta-Trinity, and Mendocino. Also in this region is Redwood National Park, a network of state parks and wilderness areas, Jackson State Forest, as well as forests on private land (such as the well-known Headwaters redwood forest in Humboldt County). Although the region has received much attention for its ancient redwood forests, some areas also contain extensive tanoak forests. The northernmost detection of tanoaks infected with Sudden Oak Death (SOD) were found in the Klamath bioregion.

Portfolio Sites

Redwood National Park is known for redwoods, of course, but also contains extensive tanoak forests. To date these tanoaks are not infected with the pathogen causing Sudden Oak Death (SOD). Oregon oak, black oak, and canyon oak occur on the drier slopes and bottomlands.

Humboldt Redwoods State Park also contains stands of tanoaks. This was the furthest north location that SOD was detected in 2000, with 11% of the tanoaks infected.

Hopland Field Station on the Russian River is engaged in active efforts at oak regeneration (Pavlik et al. 1991). This University of California field station is a site of active research on oak woodland issues (see Merenlender and Crawford 1998; Merenlender et al. 1998).

McLaughlin Reserve is a recent addition to the UC Davis Natural Reserve System and is located in the inner North Coast Range, at the junction of Napa, Lake and Yolo Counties, on land owned by the Homestake Mining Company. The 2,800 ha (7,050 acre) site, of which 20 % is oak woodland, is in transition: the Homestake gold mine is in its last phases of operation, and the McLaughlin Reserve is beginning to be used for teaching and research. It is surrounded by some 30,000 hectares (75,000 acres) of land managed by the US Bureau of Land Management (BLM).

The Northern California Coast Range Preserve is an immense region (7,800 acres) managed jointly by The Nature Conservancy and the University of California. Oak habitats include tanoak, black oak, Oregon oak and others. SOD infection occurs in populations of tanoak and black oak. If SOD continues to expand, this region would be important in understanding how to manage the acorn production of other oak species as tanoaks and black oaks decline.

Central Coast

California's Central Coast is characterized by a mild climate, beautiful coastline, small mountain ranges that roughly parallel the coastline, and a wide variety of habitat types. The favorable climate in this region supports a robust agricultural industry that includes vineyards, row crops and grazing.

In recent years, the Central Coast has undergone a dramatic population increase, fueled largely by prosperous industries such as Silicon Valley's booming computer industry. This sudden and expansive growth threatens the region's habitats through land conversion, water

diversion, logging, resource extraction, grazing, and habitat clearing. Some of the worst effects of SOD are visible on the coastal forests in this region, predominantly affecting tanoak and coast live oak, and occasionally black oak.

Portfolio Sites

Hunter-Liggett Military Reservation is an extensive area where considerable research has been conducted on oak woodland ecology and prescribed fires (Tietje et al. 1997). This reservation may be an important area for various management ideas on the SOD epidemic and other oak woodland issues to be implemented and explored.

Pfeiffer Big Sur State Park contains 800 acres of oaks and other forested habitats. Of all the sites monitored in 2000, this was one of the hardest hit by SOD. Nearly 90% of tanoaks and more than half of other oak species (coast live oak, interior live oak and black oak) were dead or dying. Understanding how the acorn-dependent bird community copes with such devastation over the next few years will be crucial.



Hunter-Liggett Military Reservation photo by Sandy Scoggin, PRBO

Henry Cowell Redwood State Park is located within the Santa Cruz Mountains and is home to a number of forest habitats, including tanoak, coast live oak, redwood, ponderosa pine, madrone and Douglas-fir. It is another area hit particularly hard by SOD. Some 47% of the tanoaks here were dead or dying in 2000.

Hastings Natural History Reservation is located in the foothills of the Santa Lucia Mountains in Monterey County. Its 2000 acres are administered by the Museum of Vertebrate Zoology at the University of California, Berkeley as part of the UC Natural Reserve System. Oak woodlands dominate the landscape, including valley and blue oak hillsides as well as live oak and mixed hardwood forests. The reserve is a biological field station containing numerous long-term data sets pertaining to the natural history and population biology of native species in these oak woodland habitats. It is a prime area for conducting research on the region's wildlife and ecology. Bird data sets it is renowned for include the long-term study of Acorn Woodpeckers and of Western Bluebirds.

Sedgewick Reserve is a UC Natural Reserve administered by UC Santa Barbara. Encompassing 2,382 hectares (5,883 acres) in the Santa Ynez Valley, the reserve includes

several types of oak woodland habitats: coast live oak forest, blue oak woodland, and valley oak savannah. The site is home to several studies on oak ecology and the factors influencing oak regeneration.

Bay-Delta

The Bay Area-Delta Bioregion includes the San Francisco Bay area and spreads eastward to encompass the sprawling Sacramento-San Joaquin River Delta. The climate is relatively mild, with fog on the coast, warm summers inland, and wet winters. The pressure for development in this very populous region is high. This area is host to a great variety of habitat types and associated avifauna. In fact few areas in the country have such a mix of dense population centers amongst a fairly diverse wildlife setting. It is in this region that SOD was first discovered in 1995. The vineyard industry is also booming in this region.

Portfolio Sites

Marin Municipal Water District is an area containing many habitats, including tanoaks, black oaks and coast live oaks. Many of these forests are also infected with SOD. Because the Point Reyes Bird Observatory conducted extensive point counts in the watershed before the emergence of SOD in this region, there is a unique opportunity for evaluating the effect on the bird community of this epidemic as it progresses, particularly those species dependent on acorns. Researchers from the University of California (Don Dahlsten and Bill Tietje) are also studying the impact of SOD on birds and other small vertebrates in this area.

Point Reyes National Seashore and the Golden Gate National Recreation Area are also areas in Marin County that are host to very diverse habitats, including those where oaks are present or predominant. These lands are owned and managed by the National Park Service. Many of these forests are also infected with SOD. The Point Reyes Bird Observatory also conducted extensive point counts in all habitat types within these parks before the emergence of SOD in this region.

China Camp State Park, located on the San Pablo and San Francisco Bays, is another site of extensive research on the new SOD problem. Coast live oak and black oak are dead and dying here. Valley oak nearby is, to date, unaffected.

Cosumnes River Preserve contains one of the finest stands of valley oak forests remaining in the Central Valley. This nature preserve is cooperatively owned and managed by The Nature Conservancy, Ducks Unlimited, U.S. Bureau of Land Management, California Department of Fish and Game, Department of Water Resources, and Sacramento County Department of Parks and Recreation. An ambitious regeneration project has been implemented (Pavlik et al. 1991).

The **Mount Hamilton** Region is an extensive open space in the central Diablo coastal range south and east of San Jose. The area contains extensive public lands, including the

Sunol Regional Wilderness and the **Henry Coe State Park**. The Nature Conservancy is building on this basis by securing the permanent protection of key private properties that surround and connect the public lands. This provides a rare opportunity to manage for oak woodland viability on a landscape scale.

South Coast

The South Coast Bioregion includes miles of sandy beaches and steep cliffs along the coast, small mountain ranges, and extensive conifer and scrub habitats. The climate is arid and warm throughout the year. The human population is very large and continues to expand rapidly, converting and fragmenting native landscapes at an alarming rate. Much land falls under the jurisdiction of forest service (Angeles, Los Padres, Cleveland, and San Bernardino National Forests), state and local parks, state beaches, and federal wilderness, recreation areas and wildlife areas. The Channel Islands off the coast of Los Angeles contain several endangered endemic species of California, including island oak. Island oak is the rarest of all oak tree species in California.

Portfolio Sites

Santa Cruz Island Preserve, managed by The Nature Conservancy, contains numerous stands of island oak and at least seven other oak species (Pavlik et al. 1991). The ongoing removal of feral ungulates (goats, sheep, and pigs) will hopefully provide opportunities to manage and restore regeneration in this key species.

Santa Rosa Plateau Ecological Reserve, a 8,300 acre Nature Conservancy property in Riverside County, is an important reserve for Engelmann Oak savannah habitat.

The **Nature Reserve of Orange County**, although perhaps better known for its coastal sage scrub habitat, also contains oak woodlands and is the site of a demographic bird monitoring project. This 38,000-acre reserve combines 21,000 acres of Irvine Company land with 17,000 acres of county and state parks, as well as other public and private lands

Mojave and Colorado Desert

These regions are dominated by the expansive deserts of southeastern California. Climate is characterized by hot, dry summers and fairly cold winters. Few people inhabit this bioregion, but it is already growing as population pressures in the rest of the state increase. Oak woodland is very sparse in these regions (less than a 10th of a percent of the total area) but small pockets do exist, including blue oak woodland, oak/pine foothill, and black oak habitats.

Sierra

The Sierra Bioregion spans a vast and mountainous area, characterized primarily by the extensive and rugged Sierra Mountains and the arid eastern portion of the state. It is a region rich in biodiversity, containing over half the plant species found in California and more than 400 of the state's terrestrial wildlife species (RAC 1998). Evidence suggests that many of the region's more common birds may be in decline (Siegel and DeSante 1999). In the montane regions this area is the key domain for black oak in California, and blue oak

woodland and blue oak/foothill pine habitats are found in the foothills. The booming vineyard industry certainly extends into and threatens these blue oak habitats of the Sierra Bioregion. While almost all of the blue oak woodlands in this region are on private land (SNF 2000), the majority of the Sierra Bioregion lands are managed by public agencies, and much of the black oak forests are in national forests. Resource managers and landowners appear willing to invest time and money into finding more ecologically sound management practices and are incorporating conservation recommendations into work plans and project goals (Siegel and DeSante 1999, SNF 2000).

An extensive review of the conservation needs and recommendations for much of this region has been provided in the Avian Conservation Plan for the Sierra Nevada Bioregion (Siegel and DeSante 1999), the Sierra Nevada Ecosystem Project (Davis and Stoms 1996), and the Sierra Nevada Framework (SNF 2000). The Sierra Nevada Framework summarizes the history, ecology and conservation issues in Sierran oak (and other) habitats, and recommends management alternatives to be implemented in national forests of this region (www.r5.fs.fed.us/sncf).

Portfolio Sites

San Joaquin Experimental Range is a USDA Forest Service research facility located in the foothills of Madera county. The oldest rangeland research station in California, its 1875 hectares (4600 acres) consist of blue oak/foothill pine woodlands and annual grasslands. The site has a long history of research and education on oak ecology, wildlife, range management, water quality, and other aspects of the ecosystem. It also contains one of the longest-running bird monitoring efforts in California oak woodlands (Verner et al 1997, Purcell et al. in press). Currently SJER is managed by California State University Fresno, under a long-term agreement with the USDA Forest Service, Pacific Southwest Research Station.

Yosemite Valley, in Yosemite National Park, is undergoing extensive restoration of once-extensive black oak woodlands (Pavlik et al. 1991).

The **Lassen Foothills** region is an extensive area of grasslands and Blue Oak woodlands. The Nature Conservancy is working to protect this area from fragmentation by promoting conservation easements and acquiring land. Two preserves here run demonstration projects that include habitat restoration, rotational grazing, prescribed burning, and other range management techniques with potential to benefit oak woodlands.



Chapter 7. Implementation of Conservation Plan Recommendations

An implementation strategy for the Oak Woodland Bird Conservation Plan is in development. It will include the engagement of local, bioregional conservation efforts to better define bioregional priorities for acquisition, restoration, and focused conservation efforts. The implementation process will eventually include a series of local workshops to:

- Familiarize local organizations with the Conservation Plan and the Implementation Plan
- Identify local initiatives, projects, and organizations capable of working as local partners to achieve habitat, restoration, and population targets.
- Develop conservation and restoration acreage objectives based on inventory, assessment and biological need.

The North American Bird Conservation Initiative

In 1998, participants at a meeting of the International Association of Fish and Wildlife Agencies developed a vision to link all of the major bird conservation initiatives in Canada, the U.S. and Mexico (CEC 1998).

The participants represented each of the four major bird conservation initiatives already underway on the continent: The North American Waterfowl Management Plan (the oldest and most successful of bird conservation initiatives), Partners in Flight, the Shorebird Conservation Plan,

and the Colonial Waterbird Conservation Plan. This new overarching program, known as the North American All Bird Conservation Initiative (NABCI), seeks to synthesize the efforts of all these groups by creating “regionally based, biologically driven, landscape-oriented partnerships delivering the full spectrum of bird conservation across the entirety of the North American continent, including simultaneous, on-the-ground delivery of conservation for both game and nongame birds.” See www.nabci-us.org for more information.



State, provincial, federal and non-governmental representatives from Canada, Mexico, and the U.S. adopted an ecological framework that facilitates coordinated conservation planning,

implementation, and evaluation among major bird initiatives. These Bird Conservation Regions (BCRs) were defined by adopting the hierarchical framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC).

Existing joint ventures as formed under the North American Waterfowl Management Plan (NAWMP) are recognized as important vehicles for local and regional delivery of bird conservation goals. Joint venture focus areas do not always correspond with BCR boundaries, but joint ventures are coordinating with the BCRs encompassed within their boundaries. Many joint ventures in North America have embraced the concept of “all-bird” conservation.

California is encompassed within five BCRs: the Northwestern Pacific Rainforest region, the Sierra Nevada region, the Coastal California region (which includes the Central Valley), the Great Basin region, and the Sonoran and Mohave Deserts region. The state currently hosts five Joint Ventures: the Central Valley Habitat Joint Venture, the San Francisco Bay Joint Venture, and the Riparian Habitat Joint Venture (all located entirely within the state), and the Intermountain West Joint Venture and the Pacific Coast Joint Venture (both located partially within the state). Future bird conservation in priority habitats of California will be achieved by encouraging adoption of the all-bird conservation concept within existing joint ventures of the North American Waterfowl Management Plan and/or by expansion of the Riparian Habitat Joint Venture to include other habitat types.

The following is only a partial list of programs and agencies with which CalPIF intends to interface in implementing this plan:

Non-governmental Organizations:

American Farmland Trust
 California Oak Foundation
 California Native Grass Association
 California Native Plant Society
 California Farm Bureau Federation
 Cosumnes River Project
 California Cattleman’s Association
 Solano Farmlands and Open Space Foundation
 Point Reyes Bird Observatory
 Wildlife Conservation Society
 National Audubon Society
 National Fish and Wildlife Foundation
 The Nature Conservancy
 Wildlife Conservation Society

Private Organizations:

Hedgerow Farms
 California North Coast Grape Growers Association
 Wine Institute
 Napa Valley Vintners Association
 Sonoma County Vintners and Growers Association
 Carneros Quality Alliance

Certified Rangeland Managers
Registered Professional Foresters

University Organizations:

University of California Integrated Hardwood Range Management Program
University of California Cooperative Extension (UC-Berkeley, UC-Davis)

State of California Organizations:

California Department of Fish and Game
California Department of Forestry and Fire Protection
Sonoma County Agricultural Preservation and Open Space District
Resource Conservation Districts (many occurring in the range of oak woodlands)
State Park System in California
Wildlife Conservation Board

Federal Organizations:

USDA Forest Service
US Fish and Wildlife Service
Bureau of Land Management
Natural Resource Conservation Service
Bureau of Reclamation



Chapter 8. Conservation Action Recommendations

Specific recommendations for conservation action are offered here. Each recommendation is accompanied by a brief discussion of the scientific evidence that supports it. These recommendations cover actions in several areas:

- habitat protection and restoration
- land management
- monitoring and research
- policy

Many of these recommendations follow those made by other organizations, or complement them. The goal of these recommended actions is to facilitate the protection and restoration of oak woodland habitat, including the successful recruitment of new oaks for future generations of the wildlife that depend on them. Only by restoring the processes involved in oak regeneration can oak woodland birds be secured a future, and thus avoid their listing as threatened or endangered species. Likewise, restoring oak regeneration will contribute to preserving sustainable working landscapes. It is our hope that these recommendations will help galvanize and guide the programs of conservation organizations, expenditures of government agencies, and the actions of private and public land managers.

Most recommendations are supported by the most recent scientific data and analysis available and a synthesis of ecological literature on oak woodlands. Additionally, recommendations were derived from focal species accounts (see <http://www.prbo.org/calpif/>). Some recommendations are, as of yet, poorly supported by data, but can be evaluated through biological research, monitoring, and adaptive management. This process will allow the continuing refinement of these recommendations and the development of more effective management and restoration strategies.

Habitat Protection Recommendations

OBJECTIVE 1

Prioritize oak woodland sites for protection.

Recommendations

1.1. Prioritize sites with intact oak regeneration and decay processes.

One of the greatest threats to oak woodland habitat in California is the lack of oak regeneration, specifically in blue, interior live, Oregon white, and valley oak communities. Habitats that presently harbor healthy bird populations will fail to support future generations of oak woodland-associated bird species if regenerative processes are not intact.

Regeneration may be considered to be adequate if the number of seedling and sapling oaks is sufficient to offset mortality (Standiford and Tinnin 1996). Oak recruitment may be episodic, and therefore sites that currently lack young oaks may still be viable in the future. However, prioritizing sites that are presently demonstrating healthy oak regeneration constitutes a step towards insuring viable habitat for future bird populations.

Other important parts of an ecologically functioning oak woodland system are acorn production and oak tree decay. Four oak woodland-associated species, Acorn Woodpecker, Yellow-billed Magpie, White-breasted Nuthatch and Western Scrub-Jay, depend on acorn production as a food source and in turn, are instrumental in the dispersal process needed for oak regeneration. Ten of the oak woodland-associated focal species depend on decaying trees and limbs for nest cavities and also, in the case of Acorn Woodpecker, Oak Titmouse and White-breasted Nuthatch, for storing food.

1.2. Prioritize sites according to current indicators of avian population health.

Conservation efforts should use the most recent information regarding the present quality of habitat and wildlife populations to prioritize the acquisition and protection of sites. Although it is unknown whether demographic bird monitoring data can predict the regenerative potential of oak woodland habitats, they do provide a means to prioritize habitat quality in its present condition.

1.3. Prioritize sites to include diverse age structure of oak trees, especially large old oak trees.

Protecting sites with a diverse age structure of oak trees will provide a continuum of seeding phenologies, preventing synchronous or wide-scale acorn crop failures. Maintaining large old oaks within a diverse age structure will provide decaying limbs necessary for bird nesting sites in addition to high output acorn production. McDonald (1990) demonstrated that Black Oaks much reach 30 years before producing viable acorns and seldom produce large quantities of acorns until they reach 80-100 years. Good acorn producing trees can continue abundant production up to 200 years.

Territorial requirements for the Acorn Woodpecker, a species instrumental in acorn dispersal, include large central trees for nesting, granary and roosting, surrounded by a periphery of smaller or medium sized trees.

1.4. Prioritize sites to represent a diversity of oak woodland types.

The full range of variation in oak woodland habitat types (and associated animal species) can be protected by: 1) protecting a diverse portfolio of sites located in different parts of the geographic and elevation range of oak woodlands, and 2) protecting individual sites that contain a variety of oak woodland types. Protecting the variety of oak woodland types may help protect the various birds that are associated with different types of oak woodland habitats. For example, Lark Sparrows are likely to be found more often in open, savanna-like oak habitats (Small 1994), while Dark-eyed Juncos may be more abundant in denser

woodlands with a thick understory (Tietje et al. 1997). Some bird species also appear to occur in higher numbers when the diversity of oak woodland types present in the surrounding landscape is higher (Stralberg and Williams, 2002).

1.5. Prioritize sites according to surrounding land use.

Certain uses of land adjacent to oak woodland habitat may negatively impact the quality of that habitat for native birds. For example, oak woodlands that are adjacent to pastures or residential developments may be more accessible to European Starlings, which compete for nest cavities with other secondary cavity nesters (Verner et al. 1997, Merenlender et al. 1998). Urban or suburban development may also have a negative effect on the presence or abundance of some bird species, including Lark Sparrow and Rufous-crowned Sparrow, in adjacent oak woodlands (Stralberg and Williams, 2002).

1.6. Prioritize oak woodland sites adjacent to intact chaparral, grassland, pine or and riparian habitats.

Riparian areas are especially important to many species of birds and other wildlife that are also found in adjacent oak woodlands (RHJV 2000). An analysis using the California Wildlife Habitat relationships System (CWHR) predicted that 150 species of birds use riparian habitat within or adjacent to oak woodlands for breeding, feeding and/or cover (see Chapter 4 in Standiford and Tinnin 1996). Many birds that are more typical of chaparral or grassland habitats can also be found in adjacent oak woodlands. Thus, the bird community found within oak woodland patches is strongly influenced by the type of habitat that surrounds them (Sisk et al. 1997).

1.7. Prioritize sites according to landscape variables (patch size, shape, connectivity) that adequately support the desired populations of oak woodland-dependent species.

Large, unfragmented, and connected areas of oak woodland should have high priority for protection, for a number of reasons. Bird species composition can be altered by habitat fragmentation. For example, the proportion of neotropical migrant species in the bird community was found to be higher in undeveloped oak woodland than in ranchette developments (Merenlender et al. 1998). The same study found a number of bird species to be more abundant in subdivided oak woodlands. These include Western Scrub-Jay, a common predator on the nests of other birds, and European Starling, an exotic competitor of cavity nesting birds (Purcell and Verner 1999). Stralberg and Williams (2002) found several bird species, mostly neotropical and short distance migrants, to increase in abundance with the proportion of oak woodland habitat remaining in the surrounding landscape.

1.8. Prioritize sites according to management options.

Sites in which management can be used to restore natural ecosystem processes should be given a high priority for protection. For example, sites in which a natural fire regime can be

re-established might be assigned a higher priority than sites in which there is a need for strong fire suppression. Sites in which the impacts of grazing can be strictly managed may also be priorities for protection.

1.9. Prioritize sites based on conservation threats and opportunities for protection.

The above guidelines are useful for identifying the highest quality oak woodland sites in the state, however, not all of these sites will be equally threatened by imminent habitat loss and degradation. Therefore, an analysis of impending threats and conservation funding potential should be included in the prioritization process. Habitat quality, vulnerability, and conservation potential all must be considered in designing the best conservation strategies.

OBJECTIVE 2

Increase acreage of protected oak woodland.

Using the above prioritization guidelines, a variety of preservation tools should be applied to increase the acreage of oak woodland in California that is managed for birds and other wildlife. These tools include: conservation easements, fee ownership of preserves, partnerships between government agencies and nonprofits, sustainable forestry and ranching, and woodland grass banking. Future versions of this plan should contain quantitative goals for oak woodland protection.

Habitat Restoration Recommendations

OBJECTIVE 3

Prioritize oak woodland sites for restoration.

Recommendations

3.1. Prioritize restoration sites according to their proximity to existing high quality sites.

Restoration sites may be more likely to be colonized by oak woodland birds if they are close to areas of high quality habitat that can serve as sources of immigrants. Dispersal distances of oak woodland birds are largely unknown, with one exception: Acorn Woodpeckers have been shown to disperse relatively long distances (Koenig et al. 2000). However, many of the smaller, resident bird species in oak woodlands may have relatively restricted dispersal ability. If so, bird populations may be more likely to be reestablished and to persist in restoration sites that are close to areas of high quality habitat that can serve as sources of immigrants. Further research is needed to evaluate the influence of habitat isolation on oak woodland birds.

3.2. Prioritize restoration sites according to likely success of regeneration and transplanted oak viability.

Restoration sites should be prioritized according to their regenerative potential. This includes not only sites with adequate acorn production and dispersal capabilities, but also with adequate biophysical (conditions e.g., soil, water table, etc.) to support seedling growth and cultivated transplants. A GIS-based system for evaluating site suitability for valley oak restoration is being developed for Santa Barbara County by Frank Davis and associates at the University of California, Santa Barbara (Davis and Kuhn, in press, <http://www.biogeog.ucsb.edu/projects/sboak/sboak.html>).

OBJECTIVE 4

Restore protected oak woodland systems to benefit healthy bird populations.

Recommendations

4.1. Restore oak woodlands to promote oak regeneration.

Regeneration is a problem in oak woodlands with a large amount of oak mortality and not enough growth of seedlings and saplings to replace dying trees. In these areas, land managers may want to promote regeneration by protecting young trees from grazing and browsing animals or by planting acorns or seedlings. Because planting oaks requires intensive effort, it may be more efficient in some sites to protect seedlings and saplings where they are already present. Small oak trees may need protection from grazing animals until they have grown taller than the browse line. Active restoration of oak trees may be needed most on drier south-facing slopes (Brooks and Merenlender 2001). A variety of devices, such as screens and plastic tubing, as well as brush piles, can discourage browsing of small trees. A recent University of California manual on “Regenerating Rangeland Oaks in California” (McCreary 2001) is available through the UC Integrated Hardwood Range Management Program (IHRMP). Contact information for IHRMP and sources of other information on how to implement oak woodland restoration are available in Chapter 9.

4.2. Restore understory components of oak woodland systems.

Many oak woodland birds are associated with grassland and shrub components of oak woodlands (Tables 3-1 and 3-2). Oak woodlands with a shrubby understory and downed woody material support greater numbers of small vertebrates (Tietje and Vreeland 1997, Tietje et al. 1997). The presence of shrubs and brush piles in the understory of oak woodlands may also help promote the survival of oak seedlings (Callaway 1992b, Callaway and Davis 1998, Weitkamp et al. 2001).

4.3. Replace non-native annual grasses with native perennial grasses in oak woodland systems.

Re-establishing or conserving native perennial grasses in oak woodlands may benefit oak regeneration, because non-native annual grasses tend to outcompete young oak seedlings for soil moisture (Gordon and Rice 1993). Also, some birds, such as the Lark Sparrow, may benefit from the presence of native grasses (Martin and Parrish 2000).

4.4. Restore upland oak woodland habitats in conjunction with adjacent riparian restoration.

Many bird species use both riparian and upland oak habitats for different parts of their life cycle. For example, birds that breed in oak woodland habitat may use riparian habitat as corridors for the dispersal of juveniles and non-breeding adults. Riparian habitat may also be used for foraging and as migratory stopover grounds. In addition, birds nesting in riparian habitat adjacent to native upland habitat may experience lower rates of nest predation or cowbird parasitism (RHJV 2000).

4.5. Restore natural fire regimes in oak woodlands whenever possible.

Higher fire frequencies in the era before widespread fire suppression (before the 1950's) may have created conditions that favored oak regeneration (Chapter 10 in Standiford and Tinnin 1996). Thus, restoring natural fire frequencies may contribute to improved oak recruitment. Also, low-intensity prescribed burns may help reduce fuel levels and prevent large, higher intensity fires that destroy oak stands. However, oak woodlands may also be damaged when fire frequency is too high, and the idea that changes in fire frequency have influenced oak regeneration is not entirely supported by recent studies (McCreary 2001, Swiecki and Bernhardt in press). More study is needed to identify the optimal fire frequency in oak woodlands. Therefore, this is a good area for adaptive management, which requires monitoring of the effects of different prescribed burning regimes on oak woodland plants, birds, and other wildlife.

4.6. Restore a mosaic configuration of a diversity of oak woodland types.

See Recommendation 1.4.

4.7. Restore oak woodlands to meet the requirements of cavity-nesting birds.

Cavity-nesting birds make up a large proportion of the bird species and a majority of the individual birds breeding in oak woodlands (Wilson et al. 1991). Therefore restoration programs should give special consideration to meeting the habitat requirements of this guild, including both primary and secondary cavity nesters. See Recommendations 6.3, 6.4, and 6.7.



Oak Titmouse

photo by Ian Tait

4.8. Plant multiple species of oak tree when restoring oak woodlands

Sites with more than one species of oak present are more likely to support stable populations of Acorn Woodpeckers (Koenig and Haydock 1999). Other acorn-consuming species will benefit from this as well, because high oak species diversity helps to ensure that acorns will be available from at least one type of oak in a given year.

Management Recommendations

OBJECTIVE 5

Implement and time land management activities in oak woodlands to increase avian reproductive success and enhance populations.

Recommendations

5.1. Avoid the construction or use of facilities and pastures that attract and provide foraging habitat for European Starlings and Brown-headed Cowbirds.

European Starlings and Brown-headed Cowbirds are insectivorous ground feeders, and therefore are attracted to pastures, other open, short-grass areas and feedlots (Morris and Thompson 1998, Purcell et al. in press). Brown-headed Cowbirds parasitize songbird nests and European Starlings compete with native species for nesting cavities (Troetschler 1976). Recent studies suggest that European Starling populations may be increasing in oak woodlands and may be more likely to nest and forage in or near grazed oak woodlands or pastures than in the center of ungrazed areas (Verner et al. 1997, Purcell et al. in press). The degree to which Starlings and Cowbirds impact native oak woodland bird populations is still

uncertain, but their presence is likely to be detrimental for some native species. Further research is also needed to investigate whether pastures and rangelands can be managed so as to reduce their attractiveness to Starlings and Cowbirds.

5.2. Brown-headed Cowbird trapping should only be used as an interim/emergency measure.

Cowbird control has been effective in stabilizing declines of endangered species in limited populations breeding in riparian habitats. For example, cowbird trapping lowered parasitism rates in a Willow Flycatcher population on the South Fork Kern River (RHJV 2000), and populations of Least Bell's Vireos at Camp Pendleton appear to be increasing as a result of cowbird trapping (USFWS 1998). However, endangered species can never fully recover as long as they rely upon human intervention for their survival (Kus 1999). A National Cowbird Advisory Council was formed to address trapping issues, review trapping programs on a case by case basis, and advise land managers and regulatory agencies. Expert opinion suggests that cowbird trapping is at best a temporary stopgap solution, and it is preferable to manage habitat and human use in ways that lessen the negative impacts of cowbirds (Morrison et al. 1999, and the National Cowbird Advisory Council).

5.3. Limit restoration activities and disturbance events such as grazing, prescribed fire, firewood harvesting, disking, and herbicide to the non-breeding season (which varies by region, but is typically August through February in California).

Such disturbances during the breeding may have direct impacts on the nesting success of oak woodland species, especially ground or shrub nesters. These activities may be much less detrimental to birds if conducted during the non-breeding season. Although few studies have directly tested this hypothesis, a recent study found no effect of an October prescribed burn on bird abundance in coastal-central California oak woodland (Tietje and Vreeland, in press).

The effects of grazing in particular need further study. While grazing did not appear to have a large effect on oak woodland bird densities at the San Joaquin Experimental Range (Verner et al. 1997), further study is needed into possible effects on primary population parameters such as reproductive success. Grazing probably contributes to the long-term lack of oak recruitment in many areas, which will in time have serious consequences for bird populations. Thus, grazing should be managed so as to promote oak recruitment. There is some evidence suggesting that winter grazing is less damaging to blue oak seedlings than spring or summer grazing (Hall et al. 1992).

Grazing, prescribed fire, and mechanical treatments such as disking can be useful tools in habitat restoration, for example to promote the growth of native perennial grasses (Tu et al. 2001). In some cases, these treatments may be most effective during the breeding season. If so, land managers should carefully weigh the long-term benefits of the management action against the short-term costs to avian productivity. Long-term use of such treatments in the breeding season should be avoided.

5.4. Manage for a grass and shrub understory where bioregionally appropriate.

See Recommendations 4.2 and 4.3.

5.5. Manage or influence management at the landscape level.

Managing at the landscape level means taking into account interactions among the different habitat patches and ecosystems that make up a region. The presence and abundance of birds in a patch of oak woodland can be influenced by characteristics of the habitat mosaic surrounding the patch, as well as by characteristics of the individual patch (Sisk et al. 1997, Stralberg and Williams, 2002). Linking and buffering large sections of oak woodland and associated habitats may restore top predators, such as coyotes or bobcats, to the oak woodland system. These predators may, in turn, reduce populations of avian nest predators such as skunks, raccoons, and snakes (Soulé et al. 1988). Landscape-scale land-use patterns may affect the population levels of Brown-headed Cowbirds and avian predators in an area, and thus reduce avian productivity. However, research on the demographic effects of habitat fragmentation is lacking for California oak woodlands, and one study in a western landscape suggests that fragmentation may not always cause increased nest predation (Tewksbury et al. 1998). More generally, the theory of island biogeography predicts the gradual extirpation of small populations from isolated habitat fragments (MacArthur and Wilson 1967). Landscape-scale management is also needed to prevent the invasion of protected habitat patches by exotic plants and animals (e.g., Suarez et al. 1998). Implementing landscape level management often will require cooperation with regional organizations such as regional fire councils, weed abatement districts, watershed conservancies, and Resource Conservation Districts.

OBJECTIVE 6

Protect, enhance or recreate natural oak woodland processes and characteristics.

Recommendations

6.1. Maintain diverse age structure of oak trees.

See Recommendation 1.3.

6.2. Protect seedling and sapling trees to enhance oak recruitment.

Oak seedlings and saplings remain vulnerable to damage by herbivorous animals, including grazers, browsers, and small mammals, until they have grown taller than the grazing line (usually about 5 feet). Managers may want to consider placing protective structures around these young trees.

6.3. Retain decaying or dead oak trees, limbs, snags and mistletoe.

Some cavity-nesting birds, such as the Plain Titmouse and White-breasted Nuthatch, nest primarily in natural cavities (Wilson et al. 1991). Therefore, the injured and decaying trees in which these cavities often form are an important habitat element for these species. Allowing dead limbs to remain on living trees may provide entry points for decay-enhancing organisms, which in turn allow birds to excavate cavities in the rotting wood. An analysis using the California Wildlife Habitat relationships System (CWHR) estimated that over 50 species of birds use snags for breeding, feeding and/or cover (Guisti et al. 1996). Mistletoe is known to be an important winter food for Western Bluebirds (see Species Account for details).

6.4. Retain large oak trees whenever possible.

Acorn Woodpeckers will benefit from the presence of large diameter trees (> 50 cm DBH), which they prefer to use for nesting and as granary trees (Gutierrez and Koenig 1978, Wilson et al. 1991). One study in the Bay/Delta bioregion found that granaries were almost exclusively found in deciduous oaks greater than 75 cm in diameter (Wilson et al. 1991), while softwoods such as pines are preferred in other areas (see species account for more details). Sustaining Acorn Woodpecker populations is likely to be beneficial to secondary cavity nesting species, such as Western Bluebirds, which often use old excavated nests. Large trees often contain many natural cavities for nesting birds, and are disproportionately chosen for site sites by Red-tailed Hawks (Tietje et al. 1997a) . See recommendation 1.3.

Large oak trees also produce more acorns than smaller trees, providing both a source of oak recruitment and food for wildlife. Therefore, in the absence of any data on actual acorn production, the largest trees should be retained. Also, certain individual trees may produce more acorns, have more large branches and produce larger snags and logs for wildlife use than other trees. Therefore, these especially valuable individual trees can be identified and retained to benefit birds and other wildlife. The acorn production of individual trees can be visually estimated in early fall (for instructions, see McKibben and Graves 1987 or Guisti et al. 1996). Acorn crops vary from year to year, so Guisti et al. (1996) recommend observing individual trees over 2-3 years and McKibben and Graves (1987) recommend observing trees in at least one high acorn production year. If data from multiple years are not available, it would still be beneficial to retain those trees that produce the most acorns in any given year, because the same individual trees tend to be good producer from year to year (Chapter 9 in Standiford and Tinnin 1996).

6.5. Control and eradicate non-native animal species.

The presence of non-native animals, such as European Starlings, feral cats, and pigs, may be harmful to native birds. Non-natives may compete with or prey on native birds, or may impact the suitability of oak woodlands for birds via their effects on vegetation. A recent study suggests that feral pigs may have significant negative impacts on acorn availability for wildlife and the establishment and growth of oak seedlings (Sweitzer and Van Vuren in press).

6.6. Utilize thinning of oak woodlands as a replacement for complete oak removal in rangelands.

It may be very difficult for oak woodlands to reestablish themselves after being completely removed (Brooks and Merenlender 2001). Much regeneration takes place under the canopy of larger trees where optimal conditions for establishment exist, e.g. moisture, nutrients (Swiecki and Bernhardt 1998). For example, blue oak seedlings do not survive well in areas without some canopy cover. The conversion of oak woodlands to grasslands will obviously cause reductions in the numbers of oak woodland birds present. There is some evidence that thinning of oak woodlands may not have dramatic negative effects on common oak woodland birds, especially if small patches are thinned (3 ha or less), if thinning reduces the basal area of trees by < 25%, and if large trees, trees with nest cavities, and Acorn Woodpecker granary trees are preserved (Aigner et al 1998). Leaving brush piles after thinning may cause increases in population density of some bird species, such as California Quail and Bewick's Wren. However the effects of thinning on uncommon species is uncertain. If oak woodlands are thinned, the most valuable trees for wildlife should be preserved (Garrison and Standiford 1997), as outlined above in Recommendations 6.3 and 6.4.

6.7. Manage for a diversity of oak species within the appropriate bioregion.

Research has shown that cavity-nesting birds use a variety of trees for nest sites, suggesting that these birds will benefit from having many alternative nesting substrates available (Wilson et al. 1991). Because different oak species do not mast synchronously, high oak species diversity will also help ensure that acorns will be available from at least one type of oak in a given year, thus benefiting acorn-consuming birds (Koenig and Haydock 1999).

6.8. Design and implement cultivated restoration projects that mimic the diversity and structure of a natural oak woodland plant community.

The response of birds to riparian habitat restoration suggests that cultivated restoration sites are more beneficial to birds if they mimic the diversity and structure of naturally occurring habitats (RHJV 2000). If this is also true in upland habitats, then some of the cultivated restoration recommendations in the Riparian Bird Conservation Plan may be applicable to oak woodlands. For example, this would suggest that restoration projects should include the planting of multiple species of trees as well as native understory plants such as shrubs, herbs, and grasses. Also, planting oak trees in a clustered pattern or planting young trees under the canopy of existing trees may promote the recruitment of additional oaks and benefit birds.

6.9. Maintain corridors between oak woodlands and other habitats.

Many of the birds found in oak woodlands use other habitat types during parts of their life cycles. Therefore, the diversity of birds and the health of their populations will likely be greater when oak woodlands are connected to other habitats by corridors of native vegetation.

6.10. When harvesting firewood in oak woodlands, identify and retain important resources for wildlife.

The results of one study on light firewood harvesting (basal area of trees reduced by less than 25%) in a California oak woodland suggest that protecting granary trees, nest cavities and some dead limbs, creating brush piles, and harvesting in small patches may help maintain bird populations in harvested oak woodlands (Aigner et al. 1998). In addition, Standiford (1996) recommended that following guidelines be followed: preserve individual trees which produce the most acorns, preserve at least one snag (i.e., dead tree) per acre, allow buffer zones with no harvesting adjacent to riparian areas, and protect sprouting stumps and existing small seedlings and saplings. Guidelines for how to identify which blue oaks produce the most acorns can be found in McKibben and Graves (1987). More research is needed to understand the long-term, large-scale effects of firewood harvesting in oak woodlands.

OBJECTIVE 7

In private commercially managed oak woodland habitats (i.e. vineyards, agricultural fields, and housing developments), maintain habitat characteristics sufficient to support native bird populations. Work cooperatively with agricultural researchers to encourage vineyards and orchards adjacent to existing oak woodlands to be more "bird friendly."

Recommendations**7.1. Retain connected oak patches within managed landscapes.**

Developed or agricultural areas may still provide habitat for some oak woodland birds if oak patches are retained (Scott 1993, Stralberg and Williams, 2002). The long-term health of these bird populations is not known, but is likely to be improved by connectivity among retained oak patches. See recommendation 10.1.

7.2. Retain oak trees in addition to herbaceous, grass or scrub understory.

Oak removal has historically been recommended to increase forage production for livestock. However, research suggests that removing blue oaks results in little or no improvement in forage production in areas receiving less than 20 inches of rain per year (see review of research in Chapter 5 of Standiford and Tinnin 1996). Indeed, in drier parts of the state, deciduous oak canopy cover can enhance forage production. Rangeland experts also recommend that areas where oaks are thinned should retain oak canopies of at least 25-35% to help maintain soil fertility, minimize soil erosion, and provide wildlife habitat (ibid.).

7.3. Maintain oaks around residences and other landscaped areas by avoiding soil compaction and over-watering.

Native oaks are valued parts of many yards and parks, and may be harmed by soil compaction or inappropriate irrigation. For example, watering near the base of a native oak during the warm season can cause root and crown rot. Detailed instructions for oak care are available from the California Oak Foundation and the UC Integrated Hardwood Range Management Program (see Appendix A for contact information).

7.4. Retain patches of chaparral, riparian or grassland habitats adjacent to patches of retained oaks.

The presence of these habitats adjacent to oak patches may improve conditions for native birds. See also recommendation 1.5, 1.6, and 4.4

7.5. Avoid attracting non-native bird species.

Non-native birds may compete with native birds for resources, including nest cavities. In oak woodlands, European Starlings are of particular concern in this regard. See also recommendations 5.1 and 6.5.

7.6. Avoid attracting or supporting inflated populations of nest predator species.

Homeowners can avoid this by not providing food for avian nest predators such as jays, magpies, crows, and ravens in the breeding season and by not feeding stray or feral cats.

7.7. Refrain from utilizing pesticides or herbicides if possible.

Within developed areas, landowners may benefit bird populations by avoiding landscaping methods that require the use of pesticides. Agricultural landowners adjacent to oak woodland habitat may use integrated pest management or organic productions as an alternative to pesticide use. This prevents damage to nesting birds and increases available foraging habitat.

7.8. Retain natural cavities instead of using nest boxes, whenever possible.

The loss of naturally occurring cavities cannot be completely mitigated by providing nest boxes. Although nest boxes can provide good nesting sites for several species of cavity nesting birds, they also have the potential to alter the composition of the bird community by benefiting some species more than others (Purcell et al. 1997, Mummert et al. in press). Also, if not properly maintained year after year, nest boxes can provide nest sites for non-native species such as European Starlings. Therefore, it is preferable to retain natural cavities whenever possible. In addition, nest cavities may not be a limiting factor in all oak woodlands, and natural nest availability should be assessed before implementing nest-box programs in oak woodlands (Waters et al. 1990).

7.9. Conduct management activities such as mowing herbaceous and grass layers in the non-breeding season.

See recommendation 5.3.

7.10. Seek opportunities to work with landowners and influence the layout of new vineyards to be located in oak woodlands, to ensure that oak harvest or reduction conforms as much as possible to the above recommendations.

OBJECTIVE 8

Inform private landowners of the imminent decline of oak woodlands due to habitat loss and lack of regeneration, and of the subsequent effect on landbird populations.

Recommendations

8.1. Support active outreach to private landowners through established programs such as local Resource Conservation Districts, the Natural Resources Conservation Service, and UC Cooperative Extension.

Many landowners may be interested in managing for oak woodland birds if given the opportunity to do so on a voluntary basis. Resource Conservation Districts can use their established contacts with private landowners as the basis for providing information on how to manage for oak woodland birds. For example, wine-grape growers are often interested in deploying nest boxes on their land to benefit cavity nesting songbirds and owls that may prey on pest insects and rodents. Therefore, the Southern Sonoma Resource Conservation District has recently begun a project to monitor avian reproductive success in nest boxes on Sonoma County vineyards. This project, which is a collaboration between private landowners, the RCD, UC Extension researchers, and PRBO, will provide information to landowners about the use of nest boxes in vineyard-oak woodland habitats. Such programs should be encouraged to help inform and build partnerships with private landowners.

Monitoring/Research Recommendations

OBJECTIVE 9

Provide data on pressing conservation issues affecting birds.

Recommendations

9.1. Consider reproductive success and survival rates when monitoring populations, assessing habitat value, and developing conservation plans.

The value of a habitat for oak woodland birds depends largely on their ability to survive and reproduce there (Block and Morrison 1987). Although many monitoring programs focus on species' abundances, abundance alone is an inadequate, and sometimes misleading, measure of habitat quality (Van Horne 1983). Likewise, long-term trends in bird populations depend

on survival and reproductive success rates. Therefore, monitoring programs should include the estimation of these demographic parameters whenever possible.

9.2. Conduct intensive, long-term monitoring at selected sites. In order to analyze trends, long-term monitoring should continue for more than 10 years.

Intensive long-term monitoring can provide crucial, habitat-specific information on bird population trends. Because oak woodland bird numbers are highly variable from year to year (e.g., Verner and Purcell 1999), most monitoring projects will need to continue for at least 10 years to be able to detect significant trends in abundance or to provide reliable baseline data (Verner et al. 1996). A long-term study of oak woodland birds by Forest Service biologists at the San Joaquin Experimental Range has produced many useful guidelines for designing and implementing a monitoring program (Verner and Ritter 1985, Verner 1987, Verner and Milne 1989, Verner et al. 1996). A project is currently underway, using this long-term dataset, to determine the optimal sample size and number of years required to detect population trends using point counts.

Because apparent trends in oak woodland bird populations can be caused by climatic factors, such as a period of low precipitation, rainfall and temperature should be included as explanatory variables in trend analyses (Purcell et al. in press).

9.3. Conduct selective monitoring at critical sites to determine the factors influencing nest success of representative open cup nesters: Lark Sparrow, Blue-gray Gnatcatcher, Western Scrub-Jay, California Thrasher, California Towhee and Hutton's Vireo.

Low productivity can be an important factor leading to population declines and local extinctions in open-cup nesting birds (Johnson and Geupel 1996, Gardali et al. 2000). By determining the factors associated with low reproductive success, research may identify which management and restoration actions will help prevent or reverse songbird population declines. Land managers, owners and regulatory agencies gain greater freedom in their decision-making if they conserve bird species before special-status listing becomes necessary. Monitoring key species provides gauges that allow management changes before it is too late.

Monitoring sites ideally should be selected in a methodical, randomized fashion so that the effects of various local habitat, landscape, and management conditions on reproductive success can be evaluated through statistical inference. Anthropogenic factors of interest include: grazing, prescribed fire, mowing, development density, landscaping and garden characteristics, and abundance of non-native predators.

9.4. Monitor nests in natural or excavated cavities.

Because cavity nesters make up a significant proportion of oak woodland birds, it is essential to understand the influences on their productivity when nesting in natural cavities (as opposed to artificial nest boxes). The impact of competition for nesting cavities by European Starlings on native birds should also be monitored.

9.5. Monitor effects of Western Scrub-Jay and Yellow-billed Magpie populations on other oak woodland species.

Western Scrub-jays and Yellow-billed Magpies can act as predators on the nests of other native birds (Purcell and Verner 1999). Although jays and magpies are native to oak woodland habitats, they may be a conservation threat in areas where their populations are increased due to human activities. For example, Western Scrub-jays are known to be more abundant near human developments (Merenlender et al. 1998, Stralberg and Williams, 2002).

9.6. Monitor effects of Brown-headed Cowbird and European Starling populations on other oak woodland species and research how habitat management can be used to minimize adverse effects.

See recommendation 5.2.

OBJECTIVE 10

Use information gathered in avian monitoring programs to test specific oak woodland habitat needs for bird species.

Recommendations

10.1. Identify minimum thresholds of connected oak woodlands in urban, agricultural and vineyard fragments.

To assist in conservation planning, we need to know, for example, what is the minimum number of oaks and maximum spacing between oaks that will still provide habitat for oak woodland bird species. Such information will help landowners practice “bird friendly” agriculture and development.

10.2. Study edge effects in oak woodland habitats.

Research into how oak woodland habitat edges relate to bird use, nest predation and cowbird parasitism is needed. There is some evidence suggesting that nest predation rates are lower at “soft” habitat edges than at abrupt, “hard” edges (Suarez et al. 1997, Soderstrom et al. 1998). However, no research on this subject has been conducted in western oak woodlands. Given that many of our protected oak woodlands may border unprotected or developed lands, it is important to know if edges can be managed or restored so as to minimize negative edge effects.

10.3. Compare areas heavily affected by Sudden Oak Death with those that are not, with attention to effects on acorn production, and how that affects the food chain.

Sudden Oak Death might affect bird populations through changes in forest structure and resulting changes in acorn supply and invertebrate numbers, which could potentially spread throughout the food web. Because the effects of SOD on bird populations will probably develop over a long time period, long-term, large-scale monitoring as well as shorter-term, intensive research efforts are needed. Bird monitoring projects in oak woodlands should routinely include the standardized collection of data on stand structure, including numbers of dead or dying trees, along with other habitat data.

10.4. Examine winter use of oak woodlands by bird species.

Relatively little is known about the winter ecology of oak woodland birds. More study is needed to understand which species depend on oak woodlands in winter and what characteristics of oak woodland best promote over-winter survival.

10.5. Study the association between the shrub understory and oak woodland avian diversity and composition.

Continued research on the current and historic occurrence of shrub understory and its value for birds is needed to evaluate the importance of managing for this vegetation layer in oak woodlands (Tietje and Vreeland 1997, Teitje et al. 1997).

OBJECTIVE 11

Study the effects of management practices on oak regeneration and bird populations.

Recommendations

11.1. Monitor the effectiveness of progressive grazing regimes for increasing the rate of successful oak tree regeneration.

It has been suggested that rotational grazing on subdivided pastures can increase the vigor of native grass species, reduce weeds, and promote oak regeneration (George 1991), but little research has yet been done to evaluate this management technique in oak rangelands (but see Jansen et al. 1997). The effects of specific grazing management strategies on oak regeneration and avian productivity should be studied in an adaptive management framework.

11.2. Study the effectiveness of prescribed fire to reduce non-native annual grasses and facilitate germination and growth of oak seedlings.

As outlined in Recommendation 4.5, fire is a natural process that influences oak recruitment and oak woodland structure. While light intensity fires may benefit oak growth by reducing competition with annual grasses, higher intensity fires can also damage young oaks (Teitje et al. 2001). More research on issues such as fire timing and frequency is needed to understand

how prescribed fire can best be used to promote oak regeneration, while also benefiting oak woodland birds.

11.3. Study the effectiveness of “wildlife-friendly” agricultural practices in vineyards and vineyard landscapes.

The winegrape growing industry is increasingly interested in making vineyard development and management less detrimental to birds and other wildlife. The effects of these efforts on birds should be monitored and compared with more traditional management practices in several bioregions.



Vineyards in oak habitat

photo by Geoff Geupel, PRBO

OBJECTIVE 12

Maximize the effectiveness of ongoing monitoring and management efforts.

Recommendations

12.1. Increase communication and coordination between land managers and specialists hired to implement specific projects or conduct monitoring.

Adaptive management is given much attention and is widely discussed, but land managers rarely have adequate time to evaluate the effects of their projects. When managers work with specialized experts, they have an excellent opportunity to conduct “adaptive management” on an informal basis. Experts, such as those conducting endangered species or biodiversity inventories, should be consulted and included as part of project implementation teams. By doing so, managers can quickly and easily access a wealth of detailed information about local birds, other wildlife, and their responses to management activities.

12.2. Use standardized monitoring protocol.

By standardizing monitoring techniques, researchers ensure that results can be compared across space and time. The USDA Forest Service published guidelines for standardized techniques of monitoring birds (Ralph et al. 1993). Please refer to Appendix B for more information. Standardized methods for measuring habitat variables, such as vegetation structure and composition also should be developed and adopted. Oak woodland databases should also be standardized to facilitate the sharing of Geographic Information System (GIS) datasets.

12.3. Sierra Nevada Framework efforts should seek to incorporate a program of monitoring bird populations to assess avian responses to blue oak woodland and montane hardwoods management alternatives.

12.4. Natural Communities Conservation Planning (NCCP) and development mitigation projects initiated by cities, counties, developers or other land managers should seek to incorporate long-term monitoring and current information on avian populations.

Policy Recommendations

OBJECTIVE 13

Encourage the development of new programs with two complementary goals: (1) make it easier for private landowners to foster oak regeneration on their property, and (2) make it more difficult for large-scale clearing of oak woodland to take place without adequate mitigation.

Recommendations

13.1 Support focused and creative action by the California Wildlife Conservation Board (WCB) in implementing the recently (2001) passed Assembly Bill No. 242, the Oak Woodland Conservation Act (the Act).

This bill authorizes the establishment of the Oak Woodland Conservation Fund for the protection and conservation of oak woodlands throughout the state of California, to be administered by the WCB. The Oak Woodland Conservation Fund may be used to offer financial incentives to private landowners to protect and promote biologically functional oak woodlands over time. Conservation easements, land improvement, and public education and outreach are some of the activities that may be funded as a result of this bill.

The WCB program has exciting potential for working creatively and constructively with landowners to promote good land stewardship. A program to encourage and facilitate efforts to improve oak regeneration on private lands should be emphasized statewide.

Conservation groups, Resource Conservation Districts, city and county planning departments, parks departments and private landowners should focus on the following specific objectives with respect to implementation of the Oak Woodland Conservation Act:

1. Support continued legislative appropriations to the Oak Woodland Conservation Fund on an annual basis.
2. Seek to maximize the benefits of proposed oak woodland conservation programs and projects by coordinating with local land use planning agencies and zoning guidelines.
3. Seek to influence the development of local jurisdiction “oak management plans” (required by the Act) to ensure that the ecological components necessary to support a diverse avian/wildlife oak woodland community are incorporated.
4. As provided for in the Act, seek to participate in developing the guidelines and criteria for awarding grants under this program.
5. Support or promote the use of appropriate sources of federal conservation funding for deposit into the Oak Woodland Conservation Fund. Appropriate federal sources include CARA (the Conservation and Reinvestment Act).

13.2. Promote the passage of legislation that would make large-scale removal of oaks in intact oak woodlands subject to the California Environmental Quality Act (CEQA).

Unless the environmental and cumulative impacts of oak woodland removal are considered prior to approval of land development projects, continued unmitigated habitat loss and fragmentation will occur. CEQA compliance for oaks woodland impacts may help to decelerate the loss and fragmentation of oak woodland habitats, particularly in the wine growing regions of Northern California.

13.3 Promote legislation that provides funding for oak woodland research, monitoring and management.

13.4. Promote the passage of oak preservation ordinances and smart-growth planning initiatives at the local (city and county) level, including:

- County and city general plan updates.
- Collaborative, inter-agency regional planning efforts.

County planning agencies are often interested in incorporating the conservation of oak woodland habitats into their comprehensive plans. Examples include the effort of Santa Barbara county to design an Oak Protection Program for the county’s rural areas (Leider, in press, www.sbcountyplanning.org) and Placer County’s Legacy Open Space and Agricultural Conservation Program (www.placer.ca.gov/planning/legacy/legacy.htm). Although often controversial, such policies and ordinances should be supported by conservation science and should include measurable performance standards that focus on protecting large patches of oak woodland habitat, not just individual trees (Harris and Kocher, in press).



Chapter 9. Outreach and Education

Scientific efforts for conservation have little impact without the support of affected local communities, including private landowners, government land managers, and the general public. To gain crucial support, research and management programs must share their findings and involve the interested parties at all levels of the conservation enterprise.

For the purposes of this chapter, outreach refers to communication with land managers, agencies, planners, business interests, nonprofit organizations, academia, and volunteers. Outreach activities include conferences and workshops that facilitate communication among experts, participation in land use planning, volunteer restoration and monitoring programs, field trips and classes for school children, and ecotourism.

Education, an important component of outreach, refers to the range of activities that educate and involve students and adults. Education activities include visits for classes and groups to field sites, interpretive displays, specialized curricula, and participation in festivals.

Project-Based Learning

One method of educational outreach, called project-based learning, allows an open-ended approach to solving a conservation problem. Students identify a conservation issue in their community and plan and implement conservation projects from beginning to end. Teachers and students make the important decisions, while working with biologists, business people, private landowners and others in the community. Because of this investment, students take ownership of their work, and the lessons learned are profound and long-lasting (Rogers, pers. comm.).

Conservation education sensitizes people to environmental problems and encourages them to seek solutions. As they become involved, people develop a greater connection to issues such as habitat degradation and loss, songbird declines, and species extinction. Conservationists have little hope of achieving their goals without cultivating this interest in the public.

Education programs engage participants most effectively when they involve hands-on activities. Conservation education has the whole of the outdoors as a classroom—what better way to elicit the interest and enthusiasm of students and the public?

Education Opportunities

Since oak habitats are such noticeable and accessible habitats, they provide excellent opportunities for hands-on experience for school groups. In fact, many schools and homes are surrounded by areas of open space containing oak woodland habitat. This close

proximity creates easy access for field visits to observe birds and other wildlife in this habitat. In addition, many oak woodland areas contain a bluebird nest box program. If you are involved in a bluebird nest box program make sure you are not doing more harm than help by following the guidelines of the North American Bluebird Society (<http://www.nabluebirdsociety.org/>) for proper installment, monitoring, and maintenance of nest boxes. If you would like to start a nest box program or install a nest box at your school, nature center or even home follow all the guidelines of the North American Bluebird Society.

The following is a list of key topics to emphasize in Oak Woodland educational projects:

- ◆ The different types of oaks
- ◆ The oak lifecycle and its dependency on birds for propagation
- ◆ Cavity abundance in oak woodlands supports a high diversity of cavity nesting birds
- ◆ The influence of acorns on native peoples culture and their use of fire to stimulate acorn production

The concepts and guidelines outlined above and in the Conservation Education section can be presented to the public and to students through a variety of media. Following is a list of common education opportunities and some suggestions for content:

Classroom Education

Programs in the classroom should focus on communicating key concepts to students through hands-on activities. Lessons should stress studying birds in the field - whether in the backyard, on school grounds, or in a nearby natural area - and include keeping field notes and observing natural behaviors of birds. Field trips to sites with bird conservation and monitoring projects, fosters interest and enthusiasm for wildlife and teaches students the importance of conserving birds.



photo by PRBO staff

A great way to get students interested in birds is to get them out looking at them. While access to binoculars is sometimes limiting, you can contact your local Audubon Society, Nature Center or other local wildlife education group to see if sets are available for check out. If you feel uncertain of your birding skills, contact your local Audubon Society or Nature Center to arrange for docents or naturalists who will be able to join your class for a

day of birding in the field. An invaluable experience that catches students' interest immediately is to visit a mist-netting site where students will have the opportunity to examine birds up close and interact with biologists.

There are many excellent sources for curriculum and hands-on bird activities to be done in the classroom. Through the Point Reyes Bird Observatory, Teacher Resource Packets are available containing lesson plans and activities for students of all ages, geared towards teaching students how to observe and study birds. To acquire the PRBO Teacher Resource packets contact Melissa Pitkin, 4990 Shoreline Hwy, Stinson Beach, CA 94970 (415) 868-1221 ext. 307, or email at mpitkin@prbo.org.

Each year PIF produces a resource directory containing bird related resources on education programs and materials, education web sites, activities for kids, workshops, and more. To acquire this guide contact Susan Bonfield, PO Box 23398, Silverthorne, CO 80498 or email Sbonfield@aol.com. Another useful source is *A Guide to Bird Education Resources* produced by Partners In Flight and National Fish and Wildlife Foundation. Copies of this book are available from American Birding Association Sales, PO Box 6599, Colorado Springs, CO 80934, phone 1-800-850-2473, member@aba.org.

Other Oak Woodland Educational Resources

- **North American Bluebird Society:** Bluebird Poster and Pocket Field Guide Student Packet, Bluebird Nestbox Plans, and Bluebird Newsletter P.O. Box 74 Darlington, WI 53530 608/329-6403, email: nabluebird@aol.com; Online at: <http://www.nabluebirdsociety.org/>.
- **Acorn Naturalists Materials:**
Available at: <http://www.acornnaturalists.com/p905.htm> or at 155 El Camino Real P.O. Box 2423 Tustin, CA 92781-2423 Phone 1-800 422-8886
- **Investigating the Oak Community:** a curriculum designed to involve 4th through 8th grade students in activities that will develop their awareness, understanding, and knowledge of the important role of oaks in the California landscape. Available at <http://www.californiaoaks.org/html/merch2.html>.
- **Books on Oaks and Oak Woodland Habitat:**

Grandmother Oak, Rosi Dagit, Gretta Allison (Illustrator); Roberts Rinehart Pub., Jan. 1997.

In a Nutshell, (Sharing Nature with Children Book), Joseph Anthony, Cris Arbo (Illustrator); Dawn Publications, Sept. 1999.

Oaks of California, Bruce Pavlik, Pamela Muick, Sharon Johnson; Cachuma Press, 2000 (revised).

Webs of Life (Oak Tree), Paul Fleisher, Jean Cassels; Library Bindings, January 1998.

The Life of an Oak Tree: An Intimate Portrait, Glen Keator, Susan Bazell (Illustrator); Heydon Books, April 1998.

- **The California Environmental Resources Evaluation System** (<http://www.ceres.ca.gov/>) has a great list of resources for Natural Sciences Educators at: http://www.ceres.ca.gov/education/educators/nat_sci.html
- **Cal Alive!** An interactive CD-Rom for 4th-8th graders focusing on CA biological diversity. Software is available at the following website: <http://www.calalive.org/index-big.html>.

Volunteer Involvement

Enlisting volunteers to aid in data collection and restoration is an excellent way to gain additional help. It is one of the best ways to teach people about conservation. Increasingly, families and school groups have opportunities to participate in cultivated habitat restoration projects at local parks or nature preserves. Volunteers that participate in counting and studying birds quickly develop a connection to them, which intimately involves the volunteer in the conservation effort. Furthermore, volunteers provide additional support and resources that make long-term monitoring of songbirds viable. To ensure reliable data collection, supervisors must match monitoring techniques with the skill level of the volunteer.

Volunteer projects monitoring bluebird nest boxes are an excellent way to ensure that bluebird boxes are monitored as well as providing a wonderful opportunity for volunteer involvement. If you are coordinating a volunteer bluebird nest box project please follow the guidelines of the **North American Bluebird Society**. You can find these guidelines on-line at <http://www.nabluebirdsociety.org/>.

Interpretation at Natural Areas

Interpretation is an excellent way to disseminate key concepts about bird conservation to the public. Displays at preserves, nature trails, picnic areas, and other natural areas should highlight the birds using the habitats and show the specific features of the habitat that are critical to bird reproduction and survival, including native plants. Some effective displays illustrate how individuals can make a difference at home, by planting native plants in their yards or restraining cats from killing birds. These displays should be aimed at the general public, emphasizing the causes of the decline of songbirds. Again, integrating people as part of the solution encourages their support for conservation issues.

Participation in Birding Festivals and Environmental Fairs

Birding festivals are becoming a popular means of increasing ecotourism, which can help to promote local support for conservation of natural areas—a requirement for long-term sustainability of conservation actions. Festivals also present an excellent opportunity to further educate people already familiar with birds about the scientific reasons behind bird conservation. Birders already recognize and love birds and can easily be taught the reasons for bird conservation and what a healthy population of birds needs to survive. They also constitute a pool of experienced observers who may volunteer for monitoring programs. The second Saturday in May is International Migratory Bird Day and National Keep Your Cat Indoors Day. Creating a display or festival in honor of these days is a great way to spread the word about bird conservation to your community.

Representation of bird conservation at environmental fairs is another way to reach large numbers of people and convey the key concepts behind bird conservation. Booths displaying information on how individuals can help birds along with interactive games or activities for children engage families and visitors in bird conservation topics. The National Fish and Wildlife Foundation has published *Bridges to Birding*, an interactive program for introducing birds, bird watching and bird conservation to your community. It contains step by step instructions on how to put on a festival or fair focusing on birds. To obtain a copy contact IMBD Information Center at (703) 358-2318 or IMBD@fws.gov. For more information on National Keep Your Cat Indoors Day, contact the American Bird Conservancy or visit <http://www.abcbirds.org/cats/catsindoors.htm>.

Oak Woodland Outreach

Many groups are already working together on projects to preserve and educate people about Oak Woodland habitats. Activities ranging from workshops, management guidelines, new partnerships, and educational curriculum are being conducted by these groups. The groups and their activities are summarized below:

The California Oak Foundation (COF) was founded in 1988, and provides technical assistance and educational materials to those engaged in protecting oak woodlands and planting oak trees.

The California Oak Foundation works to:

- Encourage adoption of state laws protecting oaks, general plan amendments, ordinances by local, regional, and state agencies to conserve oaks;
- Co-publish oak books and educational materials, including "Oaks of California," "The Life of an Oak," and "Compatible Plants Under and Around Oaks;"
- Develop educational curriculum and provide information to schools and other community groups for acorn planting and tree maintenance projects;

- Educate decision makers, individuals and communities about threats to our endangered oak heritage;
- Sponsor technical conferences on oak preservation and workshops on estate tax planning and conservation easements in urban and rural environments for planners, developers and landowners.

For more information see Appendix A: Resources.

University of California Integrated Hardwood Range Management Program

<http://128.48.5.253/ihrmp/>

The Program's purpose is developing alternative land use planning and range management strategies to ensure multiple use of hardwood rangelands while improving oak regeneration and maintaining diverse wildlife habitat.

Objectives:

- Develop methods to sustain hardwood rangeland ecosystems and landscapes;
- Maintain wildlife habitat on hardwood rangelands;
- Restore degraded hardwood rangelands;
- Ensure land use planning utilizing available information to conserve hardwood rangeland ecosystems;
- Maintain economically viable private hardwood rangeland enterprises;

Regional cooperative extension specialists are located throughout the State to develop applied research and outreach programs addressing conservation of hardwood rangelands with local Cooperative Extension offices and various agencies and interest groups. The Extension program also develops newsletters and educational materials. <http://128.48.5.253/ihrmp/person.html>

Projects of the Program include:

- **Workshops on Guidelines for Managing Hardwood Rangelands** -- 10 workshops were presented in FY 97-98 to extend the concepts in the recently revised handbook, "Guidelines for Managing California's Hardwood Rangelands." Presented in collaboration with local county Cooperative Extension offices. Over 450 ranchers, homeowners, local conservation groups, and resource management professionals participated.
- **Development of Local-Based Oak Woodland Conservation Policies** -- The State Board of Forestry has adopted a hardwood rangeland policy to encourage local or regionally-based conservation strategies, rather than statewide regulations. IHRMP and county CE staff have helped facilitate development of these local policies. During FY 97-98, Sonoma, Fresno, and El Dorado counties implemented new hardwood rangeland

policies. These add to the other 27 counties that have already adopted local hardwood rangeland conservation policies.

- **Monitoring of Hardwood Rangeland Resources** -- Provide local feedback into state-level monitoring carried out by USDA Forest Service (USFS) and the California Department of Forestry and Fire Protection (CDF). Change detection evaluation of seven counties in the southern Sierra Nevada was completed in cooperation with local CE advisors. Work on monitoring sources of hardwood rangeland change started in the central and northern Sierra Nevada regions.
- **Develop and Extend Restoration Efforts** -- Educational programs were held with restoration professionals, native plant nurseries, and landowners on IHRMP-developed hardwood rangeland restoration technologies. Over 150 professionals were reached directly with educational workshops dealing with this topic.
- **Vineyards in an Oak Landscape** -- Conversion of hardwood rangelands to vineyards identified as key area for new program thrust. Leaflet developed to describe hardwood rangeland conservation strategies in areas being developed for new vineyards. Local regulatory restrictions proposed in Sonoma, Napa, and Santa Barbara counties, and IHRMP and county CE advisors worked closely in developing educational opportunities to present research-based information in this policy debate. Five educational workshops were held this fiscal year on this topic. A pilot GIS mapping project started in Sonoma County.
- **Economic Value of Hardwood Rangelands** -- Concerns about validity of Williamson Act appraisal processes used in the Southern Sierra Counties led to contract with Tulare County Assessor's Office to determine a scientifically defensible appraisal process. This work completed, and extended to southern Sierra Nevada county assessors in a workshop and through printed case studies. Work has helped quantify amenity and conservation value of hardwood rangelands to support developing interest in conservation easements and land trusts to conserve habitat values of hardwood rangelands.
- **California Oak Symposia** -- Together with a number of other organizations and agencies, IHRMP recently convened the fifth in a series of symposia on oaks in California. These conferences and their proceedings are rich sources of information on a wide variety of subjects related to oak ecology, management, and conservation (Standiford 1991, Pillsbury et al. 1997).

California Association of Winegrape Growers

CAWG was founded in 1974 to represent the interests and concerns of wine and concentrate grape growers. CAWG has begun to work with the scientific and environmental community to develop and promote awareness of wildlife-friendly vineyard practices. In 2002, CAWG organized a workshop on Vineyards and Wildlife Habitat, and plans to follow up with a publication on the subject. www.cawg.org

Eastern Madera County Coarsegold Resource Conservation District Voluntary Oak Woodland Management Guidelines <http://www.crcd.org/>

The Coarsegold Resource Conservation District has provided this forum to furnish landowners with the latest information and provide educational material for their use in the management of their property. The data included on this site was developed to assist landowners in becoming better land stewards and direct them to publications and agencies for help in the management of their property.

Phytosphere Research -- (<http://phytosphere.com>) provides information needed to effectively manage plant resources in urban and rural environments, natural ecosystems, and agricultural systems. They focus especially on ecology, restoration, and management of native California oaks and oak woodlands. Their site *Understanding blue oak regeneration*: (<http://phytosphere.com/BLUEOAKF.HTM>) provides an in-depth overview of blue oak regeneration, including details on the effects of canopy and site conditions, accounting for historical regeneration patterns, sustainable management, and effects of fire and grazing. They also offer a guide to growing California oak species (<http://phytosphere.com/oakplanting/oakplanting.htm>).

Future Outreach Priorities

Outreach activities must maintain and build interest in conservation and restoration efforts in the state. To this purpose, outreach efforts should develop:

- **Greater collaboration** between woodland managers (include public and private agencies) and biologists to examine wildlife response to management practices throughout California's varied oak woodland habitats.
- **More contact with resource-based constituencies**, such as the wine-making industry, to foster collaboration in land management, in order to improve habitat for birds while ensuring that landowners can make a sustainable living.
- **Partnership with the National Association of Service and Conservation Corps** (NASCC), of which the California Conservation Corps is a part. The California Association of Local Conservation Corps also has 11 members throughout the state with a trained labor force capable of restoring habitat. These programs improve environmental quality while providing opportunities for young people to learn and develop new skills.
- **Further educational outreach**, particularly the promotion and support of volunteer monitoring programs. Volunteer monitoring programs are most needed at reference sites and others that will require long-term monitoring.
- **Oak Woodland conferences and symposia**. These will highlight recent developments in restoration biology, innovative government programs and public and private

partnerships. They will also facilitate communication among restoration biologists, regulatory agencies, land managers, and landowners throughout the state.

Opportunities for Involvement: What Can One Person Do?

An individual can have a profound impact on the life of a bird and the livelihood of a species. Human activities can encourage predation of adult birds and their nests by animals such as domestic cats, raccoons, and jays. They can alter available food resources by depleting local insects with pesticides. Finally, they can destroy or disrupt much-needed habitat for nesting and feeding young. But thoughtful activity by humans can limit these impacts and even encourage successful nesting by songbirds, contributing to the health of their population.

The guidelines below can make a critical difference in enhancing the health of a songbird population. These recommendations apply to most bird species, including oak woodland birds.

If you are a bird watcher, volunteer for a monitoring program.

There are increasing opportunities for bird watchers of all skill levels to gain training and experience in various bird monitoring techniques. Participants gain knowledge in a subject area of interest, learn new skills, and can directly contribute to the science of conservation while enjoying birds in the outdoors. There are increasing opportunities to contribute to bird monitoring projects in riparian habitats throughout the state. (See the PRBO web site <http://www.prbo.org> for ways to get involved and Appendices A and B for more information on bird monitoring techniques and the information they provide.)

If you own a cat, help reduce the impact of cats on bird populations.

Domestic cats kill hundreds of millions of native birds, reptiles and small mammals every year. This unnecessary impact can easily be reduced if cat owners would keep their cats indoors. The American Bird Conservancy's Cats Indoors! campaign seeks to educate the public on the facts of cat predation on birds and other wildlife, and the hazards to free roaming cats. This information is available at the American Bird Conservancy's web site at <http://www.abcbirds.org>.

Other actions that cat owners can take to help birds:

- **Keep cats as indoor pets.**
- **Spay and neuter your cats.**
- **Cats on ranches or farms, kept to control rodent populations, should be kept to a minimum.** Spayed females tend not to stray or wander from the barn area. Keeping feed in closed containers also helps reduce rodent populations (Coleman et al. 1997). Trapping rodents can also be more effective than relying on cats to do the job.

- **Don't feed stray or feral cat populations.** A more humane alternative for cats and wildlife is to reduce the unwanted cat population by limiting reproduction and facilitating adoption by responsible pet owners.
- **Remove food dishes or garbage that may attract stray cats.**
- **Support local efforts to remove feral cats.**

If you camp, hike, or picnic in the outdoors help maintain the natural balance between predator and prey.

Do not feed wildlife or allow wildlife access to your trash. This may lead to an increase in natural predators such as raccoons, fox, ravens, crows, jays, and opossum. Increased numbers of these predators can depress bird populations.

If you feed birds, avoid doing more harm than good.

Feeding wildlife can be beneficial if properly done, but it always carries the potential for upsetting the natural balance between native predators and prey species. Improper feeding can help to spread disease, support predator populations that prey on birds and other organisms, or increase non-native populations that displace the natives.

•**Feeder placement should be away from shrubs or bushes that provide places for cats to ambush birds (Coleman et al. 1997).**

•**Avoid feeding birds in the spring and summer.** Feeding birds supplements their natural diet, but springtime feeding may encourage a lower quality diet for nestlings who need high-protein insects, which are naturally abundant throughout the breeding season.

•**Do not supplement the diet of avian nest predators** such as jays, magpies, crows and ravens by feeding them during the breeding season. These predators tend to benefit disproportionately from human habitation, and as their populations expand they are negatively affecting the health of other bird populations. The National Audubon Society produces bird feeders that discourage use by avian predators.

•**Avoid supplementing the diet of Brown-headed Cowbirds,** which parasitize songbird nests. If cowbirds come to your feeder, try eliminating millet from the birdseed you provide. Evidence indicates that Brown-headed Cowbirds are attracted to bird feeders primarily for millet. Sunflower seeds and other types of birdseed attract many songbird species, but may not attract cowbirds.

•**When feeding birds in winter, feed them consistently.** Some wintering birds may become dependent upon winter bird feeders, thus a consistent supply of food is important. Change birdseed if it gets wet from rain as the moisture may promote mildew or sprouting, which can cause birds to become ill.

•**In feeding hummingbirds, use a solution of four parts water to one part sugar. Do not use brown sugar, artificial sweeteners or red dye.** Place the feeders in the shade and change the feeder solution every three to four days to avoid cultivating pathogens that can cause hummingbirds to become ill. In freezing weather, bring feeders indoors at dusk and return them with lukewarm fluid at dawn. Clean feeders every 10 days using a few drops of bleach in the wash water, and let stand before rinsing. Rinse thoroughly many times.

If you find an injured bird or a baby bird:

•**Baby birds will often leave the nest before they look fully-grown.** Such birds are often mistaken for “abandoned.” Their parents, however, can find them on the ground and will feed them. Most fledglings will continue to be fed by their parents even after leaving the nest. It is therefore best to leave young uninjured birds alone, as it is likely their parents are nearby. It is not true that parents will avoid young after humans have handled them. Fledglings should not generally be returned to their nest, as this may disturb the nest site. Trampled vegetation and human activity can alert predators to the presence of the nest. Allowing baby birds to remain in the care of their parents provides them their best opportunity for survival.

•**Injured birds can be taken to wildlife rehabilitation clinics and programs.** It is best to keep injured birds in a warm, dry, quiet place free from disturbance (such as a shoebox with the lid on and a few holes for air) until they can be transferred to a licensed wildlife rehabilitation facility. Call the facility before you visit.

•**Be aware that it is against federal law to collect birds or their nests without a permit.**

KEY CONCEPTS ABOUT BIRD CONSERVATION

The following list of key concepts for bird conservation should be communicated through education and outreach programs. These concepts are important to include in any program concerning conservation, and are indispensable in programs focusing on birds and riparian habitats.

- **Reproductive success may be the most important factor influencing population health.** It contributes directly to a population's size and viability in an area. A number of factors influence reproductive success, including predation, parasitism, nest site availability, and food availability.
- **Nesting habitat requirements vary among species.** Different bird species place their nests in different locations, from directly on the ground to the tops of trees. Most birds nest within five meters of the ground. Managers should consider that habitat needs for different species vary. Leave grass and forbs greater than 6 inches in height for ground nesters, shrubs and trees for low to mid-height nesters, dead trees and snags for cavity nesters, and old, tall trees for birds that build their nests in the canopy.
- **The breeding season is a short but vital period in birds' lives.** Birds nest during the spring and early summer of each year and raise their young in a rather short period. Nestlings are particularly sensitive to changes in the environment and are sensitive indicators of ecosystem health. Disturbance, such as vegetation clearing, habitat restoration, and recreation may result in nest abandonment, remove potential nest sites, directly destroy nests, expose nests to predators, and decrease food sources such as insects. Predators, such as domestic cats, skunks and jays, can decimate breeding populations, and managers should avoid subsidizing their populations.
- **Understory (the weedy, shrubby growth underneath trees) is crucial to birds.** A healthy and diverse understory with lots of ground cover offers well-concealed nest and foraging sites. Manicured parks and mowed lawns provide poor nesting conditions for all but a few bird species.
- **Native plants are important to birds.** Native bird populations evolved with the local vegetation, learning to forage upon and nest in certain species. Introduced plant species may not provide the same nutrition or nest site quality. Introduced plants can also quickly dominate an area, reducing the diversity of vegetation. Less diverse vegetation can lower the productivity and viability of a bird population.
- **Natural predator-prey relationships are balance, but human disturbance creates an imbalanced system.** Interactions with predators are a natural and essential part of an ecosystem. However, a preponderance of non-native predators or a sustained surplus of natural predators severely affects the health and persistence of bird populations. Feeding wildlife, especially foxes, raccoons, and skunks, should be discouraged. Feeders that are frequented by jays and crows and cowbirds should not be maintained during the breeding season (most songbirds feed their young insects). Domestic and feral cats are responsible for an estimated 4.4 million birds killed each day by cats (Stallcup 1991). It is not true that a well-fed cat will not hunt! In fact, a healthy cat is a more effective predator.
- **Natural processes, such as flood and fire, are integral to a healthy ecosystem.** They provide the natural disturbance needed in an area to keep the vegetative diversity high, an important factor for birds.



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Appendix A. Resources

The Oaks of California by Pavlik et al. (1991)

The California Oak Foundation

<http://www.californiaoaks.org/>

The California Oak Foundation (COF) is dedicated to protecting and perpetuating California's native oak woodlands and the wildlife habitat and watershed benefits they provide.

Contact information:

California Oak Foundation
1212 Broadway, Suite 810
Oakland, CA 94612
Tel: (510) 763-0282
Fax: (510) 208-4435
E-mail: oakstaff@californiaoaks.org

Also available at this site: *The California Oak Report* Beginning in January 2000, our Current Issues page will feature a monthly report, which will provide information to the general public about the biological role of California's oak woodlands in the landscape and the planning processes applicable to oak woodland habitats. The column also hopes to function as an interactive forum for the discussion of oak issues and as a site for the general public to submit comments, queries, oak news, etc. Automatic monthly electronic mailings of The California Oak Report are available upon request by contacting oakstaff@californiaoaks.org.

University of California Integrated Hardwood Range Management Program

<http://128.48.5.253/ibrmp/>

The Program's purpose is in developing alternative land use planning and range management strategies to ensure multiple use of hardwood rangelands while improving oak regeneration and maintaining diverse wildlife habitat. This site is a tremendous resource for information on anything related to oak woodlands.

OBJECTIVES:

- Develop methods to sustain hardwood rangeland ecosystems and landscapes;
- Maintain wildlife habitat on hardwood rangelands;
- Restore degraded hardwood rangelands;
- Ensure land use planning utilizing available information to conserve hardwood rangeland ecosystems;
- Maintain economically viable private hardwood rangeland enterprises;

- Maintain statewide information base about trend, condition, and extent of hardwood rangelands; and
- Help focus public awareness about the importance of hardwood rangeland habitats.

The Sierra Nevada Ecosystem Project

http://ceres.ca.gov/snep/pubs/web/v1/v1_default.html

Sierra Nevada Ecosystem Study (SNEP) was a congressionally mandated 3 year study of the entire Sierra Nevada range. The study was managed by the University of California Centers for Water and Wildland Resources, Davis, CA under a research agreement with the U. S. Forest Service, Pacific Southwest Research Station, Albany, CA. Posted on the above web site are final reports from this intensive study by an independent science team. Formal release of the report to Congress occurred on June 7, 1996.

Hastings Natural History Reservation

<http://www.hastingsreserve.org/OakStory/OakIntro.html>

Hastings is a Biological Field Station of the University of California providing the wildlands and facilities to conduct college and graduate level studies of natural systems in the Santa Lucia range in Monterey County, California. Our research reveals that every species has a fascinating story. Their stories put our lives in perspective. We hope that sharing these stories will inspire individuals to protect and appreciate whatever is still wild and under their care.

The Sierra Nevada Framework for Conservation and Collaboration

<http://www.r5.fs.fed.us/sncf/>

In early 1998, the USDA Forest Service Pacific Southwest Region, the Pacific Southwest Research Station and the Intermountain Region renewed their efforts to work with tribes, county governments, state and federal agencies, interest groups and individuals interested in improving the health of Sierra Nevada ecosystems and communities. The effort integrates recent science into natural resource management through a variety of approaches and at a variety of geographic scales. It also works toward more effective means of coordination, cooperation and collaboration among the various parties.

The Sierra Nevada Forest Plan Amendment Environmental Impact Statement is one of several Framework activities. At this site, you will find links to several other projects and activities going on in the Framework. The Design Paper outlines many of the commitments the Forest Service is making as part of its contribution toward improving natural resource management and collaboration among tribes, agencies, local governments and citizens.

US Department of Agriculture—Natural Resources Conservation Service Programs

While there are a variety of USDA programs available to assist people with their conservation needs, the following primarily financial assistance programs are the principal programs available. Locally led conservation groups are encouraged to contact the State offices of the appropriate agency for specific information about each program.

For more information about any of the following NRCS programs: <http://www.nrcs.usda.gov/>

Natural Resources Conservation Service

Attn: Conservation Communications Staff

P.O. Box 2890

Washington, DC 20013

Forestry Incentives Program

<http://www.nrcs.usda.gov/CCS/FB96OPA/FBillLnk.html>

The 1996 Farm Bill extends the Forestry Incentives Program (FIP), which was originally authorized in 1978 to share up to 65 percent of the costs of tree planting, timber stand improvements, and related practices on non-industrial private forest lands. FIP's forest maintenance and reforestation provide numerous natural resource benefits, including reduced wind and soil erosion and enhanced water quality and wildlife habitat as well as helping to assure a reliable future supply of timber. Improving timber stands, which help to sequester greenhouse gases, also contributes to the President's Climate Change initiative. FIP is administered by the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) and Forest Service.

Program Availability

FIP is a nationwide program available in counties designated on the basis of a Forest Service survey of total eligible private timber acreage that is potentially suitable for production of timber products. Federal cost-share money is available—with a limit of \$10,000 per person per year with the stipulation that no more than 65 percent of the cost may be paid. To find out if your county participates in FIP, check with your local USDA office, State forester, conservation district, or Cooperative Extension office.

The Wildlife Habitat Incentives Program (WHIP)

<http://www.nrcs.usda.gov/PROGRAMS/Animals/wbip/index.htm>

A voluntary program for people who want to develop and improve wildlife habitat primarily on private lands. It provides both technical assistance and cost-share payments to help establish and improve fish and wildlife habitat.

Participants who own or control land agree to prepare and implement a wildlife habitat development plan. The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) offers participants technical and financial assistance for the establishment of wildlife habitat development practices. In addition, if the landowner agrees, cooperating State wildlife agencies and nonprofit or private organizations may provide expertise or additional funding to help complete a project.

Conservation Technical Assistance (CTA)

The purpose of the program is to assist land-users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. The purpose of the conservation systems are to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

Conservation Reserve Program (CRP)

The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

US Fish and Wildlife Service—Partners for Fish and Wildlife

The mission of the U.S. Fish and Wildlife Service is, by working with others, to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The Service's Partners for Fish and Wildlife program, formerly named the Partners for Wildlife program, helps accomplish this mission by offering technical and financial assistance to private (non-federal) landowners to voluntarily restore wetlands and other fish and wildlife habitats on their land. The program emphasizes the reestablishment of native vegetation and ecological communities for the benefit of fish and wildlife in concert with the needs and desires of private landowners.

For more information about any of the following US Fish and Wildlife programs:

<http://partners.fws.gov/index.htm>

Partners for Fish and Wildlife
State Coordinator
2800 Cottage Way W-2610
Sacramento, CA 95825
916-414-6446

The assistance that the U.S. Fish and Wildlife Service offers to private landowners may take the form of informal advice on the design and location of potential restoration projects, or it may consist of designing and funding restoration projects under a voluntary cooperative agreement with the landowner. Under the cooperative agreements, the landowner agrees to maintain the restoration project as specified in the agreement for a minimum of 10 years.

Restoration projects may include, but are not limited to:

- planting native grasslands and other vegetation

- planting native trees and shrubs in formerly forested wetlands and other habitats
- prescribed burning as a method of removing exotic species and to restore natural disturbance regimes necessary for some species survival
- removal of exotic plants and animals which compete with native fish and wildlife and alter their natural habitats

B. General Information

The Information Center for the Environment, at <http://ice.ucdavis.edu/> is a cooperative effort of environmental scientists at the University of California, Davis and collaborators at over thirty private, state, federal, and international organizations interested in environmental protection. Within this site, find the California Ecological Restoration Projects Inventory (CERPI) (direct link: <http://endeavor.des.ucdavis.edu/cerpi/>) and the California Noxious Weeds Projects Inventory (CNWCPI). (direct link: <http://endeavor.des.ucdavis.edu/weeds/>)

CERPI is a combined private/non-profit/government effort to establish a database, accessible through the Internet, containing information on restoration projects in California. This information will further the practice and science of restoration and assist agencies and practitioners during restoration planning and implementation.

CNWCPI is a combined government/private/non-profit effort to establish a database, accessible through the Internet, containing information on noxious weed control in California. This information will further the practice and science of noxious weed control and assist agencies and practitioners doing noxious weed control throughout the state. CERPI and CNWCPI are both programs of the Natural Resource Projects Inventory (NRPI)

The California Environmental Resources Evaluation System

<http://www.ceres.ca.gov/index.html>

CERES is an information system developed by the California Resources Agency to facilitate access to a variety of electronic data describing California's rich and diverse environments. The goal of CERES is to improve environmental analysis and planning by integrating natural and cultural resource information from multiple contributors and by making it available and useful to a wide variety of users.

California Wildlife Habitat Relationships, at <http://www.dfg.ca.gov/wbdab/>

California Wildlife Habitat Relationships (CWHR) is a state-of-the-art information system for California's wildlife. CWHR contains life history, management, and habitat relationships information on 675 species of amphibians, reptiles, birds, and mammals known to occur in the state. CWHR products are available to purchase by anyone interested in understanding, conserving, and managing California's wildlife (Mayer and Laudenslayer 1988).

A Manual of California Vegetation (Sawyer and Keeler-Wolf) on line at

<http://endeavor.des.ucdavis.edu/cnps/>

Forest Service Technical Reports can be ordered from 970-498-1392.

Other Sources of Assistance on Hardwood Rangelands

California Department of Fish and Game
1416 Ninth St.
Sacramento, CA 95814
916-653-1738

California Department of Forestry and Fire Protection
1416 Ninth St.
Sacramento, CA 95814
916-322-0623

California Cattleman's Association
1221 H. St., Suite 101
Sacramento, CA 95814
916-444-0845
email: staff@calcattlemen.org

The Nature Conservancy
785 Market St.
San Francisco, CA 94103
415-777-0487

California Native Plant Society
909 12th St., Suite 116
Sacramento, CA 95825

California Farm Bureau Federation
1601 Exposition Blvd.
Sacramento, CA 95815
916-561-5500
email: cfbf@cfbf.com

Appendix B. How to Monitor Bird Populations

Adaptive management requires the periodical gathering of information to ascertain whether management actions are achieving desired results. The most comprehensive and rigorous way of collecting this information is through a strategic program of monitoring using standardized methods that can be compared between years and between regions. Restoration and land stewardship programs need to build in long-term monitoring programs to assess the effectiveness of their activities. Without such data in the long term, such programs will ultimately have little on which to base claims of success or the need for continued funding.

Research and Monitoring

If habitat restoration or management is undertaken to benefit wildlife species, wildlife monitoring becomes the ultimate measure of success. There are many reasons that bird monitoring should be adopted as a basic component of long-term stewardship in preserves with significant habitats or significant bird populations:

- Birds are highly visible and cost effective to monitor.
- Birds can show relatively quick response in abundance and diversity to restored habitats (3 to 5 years).
- Birds can serve as indicators for key components of ecosystem health, such as acorn productivity, oak age structure, and understory vegetation composition.
- As secondary consumers (i.e., insectivores), birds are sensitive indicators of environmental change.
- By managing for a diversity of birds, most other elements of biodiversity are conserved.
- Bird monitoring can avoid future listing of declining species by identifying problems and solutions early.
- The only way to measure special-status bird species response to management and restoration is by monitoring bird populations.
- Because of the increasing popularity of birdwatching, there is great potential for public participation in bird monitoring.
- Birds are tremendously important culturally and economically and their popularity can help raise awareness of land-stewardship needs.

Monitoring Strategically

Monitoring can be conducted at varying levels of intensity, depending on the objectives to be achieved and the resources available. The standardization of protocols is critical to comparing results across space and time. Many recent programs (Ralph et al. 1995, Martin et al. 1997, DeSante et al. 1999a) and publications (Ralph et al. 1993, Geupel and Warkentin 1995, DeSante et al. 1995, 1998, 1999b, Nur et al. 1999) have summarized methods, objectives, and how to use results.

Monitoring programs should always include an analysis plan and identification of issues or site-specific projects to be assessed. The primary purpose of site-specific monitoring is to assess the effects on wildlife of natural and anthropogenic stressors or disturbances in the environment. This knowledge is critical in determining the relative priority of identified conservation problems and in developing effective measures to address those problems. Monitoring is an integral component of the adaptive management feedback loop, allowing land managers, conservation groups, and land owners to assess the effectiveness of their habitat management and restoration programs.

Standardized monitoring across many sites at varying scales can be analyzed to highlight broad changes or trends in species presence, diversity, abundance and productivity. Ideally, a series of reference sites with long-term monitoring, using most if not all protocols below, will be developed for each California bioregion. Other sites will be monitored more opportunistically, depending on the objectives of the landowner.

The following is a list of common monitoring regimes from least to most intensive.

1) Rapid assessment of habitat or designation of Important Bird Areas based on general vegetation characteristics and presence/absence of indicator species.

Method: area search or point count as little as one census per site per year.

2) Determine breeding status, habitat association, restoration evaluation and/or evaluation of changes in management practices.

Method: area search or point count two or more times per year for 3 years. For restoration evaluation every other year, censusing should continue for at least 10 years.

3) Determination of population health or source/sink status.

Method: census combined with demographic monitoring for a minimum of 3 years (4 years preferable).

4) Reference site.

Method: point count census, constant effort mist netting and nest monitoring at a minimum of every other year for 10 years.

Long-term Monitoring

Long-term monitoring provides a wealth of useful information about bird populations. In addition to parameters that can be determined by both short- and long-term monitoring (such as annual productivity, abundance, and diversity), patterns of variation in reproductive success and trends in abundance and diversity may also be described. Long-term monitoring is also the only method to monitor natural and human-induced changes in bird populations.

The Palomarin Field Station of the Point Reyes Bird Observatory provides an excellent example of the utility of a long-term monitoring program. Biologists have conducted mist-netting at the site for over twenty years. With the data collected, they have documented a population decline of Warbling Vireos and linked it to reproductive failure on the breeding grounds (Gardali et al. 2000).

Standardized Methods Adopted by the Western Working Group and Monitoring Working Group of Partners in Flight

These are listed from least to most intensity of effort. All are described in detail in Handbook of Field Methods for Monitoring Landbirds (Ralph et al. 1993).

Area Search

The Area Search, adopted from the Australian Bird Count, is a habitat specific, time constraint census method to measure relative abundance and species composition. It may also provide breeding status. While still quantitative, this technique is ideal for volunteers as it mimics the method that a birder would use while searching for birds in a given area, allowing the observer to track down unfamiliar birds.

Point Count

The point count method is used to monitor population changes of breeding landbirds. With this method, it is possible to study the yearly changes of bird populations at fixed points and differences in species composition between habitats and assess breeding status and abundance patterns of species. The objective of point count vegetation assessment is to relate the changes in bird composition and abundance to differences in vegetation. These vegetation changes can either be over time or differences between habitats or study sites.

Mist Netting

Mist netting provides insight into the health and demographics of the population of birds being studied. Mist nets provide valuable information on productivity, survivorship, and recruitment. With these data, managers will have information on the possible causes of landbird declines or their remedies. This method is currently being used nationwide in the Monitoring Avian Productivity and Survivorship (MAPS) program (DeSante 1992).

Territory Mapping

Also known as “spot mapping,” based on the territorial behavior of birds, where locations of birds are marked on a detailed map during several visits (a minimum of eight) in the breeding

season. By counting the number of territories in an area, this method estimates the density of birds. Distribution of territories, species richness, and diversity is also documented. This is an excellent method for assessing areas with limited habitat. Standard methods are described by Robbins (1970) and used by The Cornell Laboratory of Ornithology's resident bird counts.

Nest Monitoring

Also called nest searching, this technique measures nesting success in specific habitats and provides information on trends in recruitment; measurement of vegetation associated with nests may identify habitat influences on breeding productivity. Examination of nests also allows collection of life-history data (e.g., clutch size, number of broods, numbers of nesting attempts), which provide important insight into vulnerability of species to decimation or perturbations (Martin and Geupel 1993).



Western Scrub-Jay on nest

photo by Ian Tait