The Coastal Scrub and Chaparral Bird Conservation Plan

A Strategy for Protecting and Managing Coastal Scrub and Chaparral Habitats and Associated Birds in California

A Project of California Partners in Flight and PRBO Conservation Science

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Version 2.0

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TABLES AND FIGURES

Executive Summary

This Coastal Scrub and Chaparral 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 coastal scrub/chaparral habitats and wildlife. The geographic scope of this plan is the distribution of low-elevation shrublands west of the state's major mountain axis. Thus, the plan covers shrubland habitats occurring in the coastal bioregions of California plus the San Joaquin Valley, including coastal scrub, chaparral (with the exception of montane chaparral), and valley semidesert scrub. The plan focuses on data concerning bird species that are dependent on these habitat types, but if implemented, its conservation recommendations would benefit many scrub- and chaparral-dependent species.

This conservation plan, along with the associated Geographic Information System (GIS) database of bird monitoring data obtained in coastal scrub and chaparral habitats (maintained at PRBO Conservation Science, PRBO), is the first iteration of a continuous process of updating habitat conservation recommendations based on the latest scientific data. This is not a regulatory document, nor does it represent the policies of any agency or organization. The GIS 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

The majority of California's population lives in the coastal region, where habitats such as chaparral and coastal scrub are a dominant feature of the natural landscape. This shrubland element of California's terrain also epitomizes the arid West. However, chaparral and coastal scrub habitats are among the most threatened and least protected of California habitat types (Davis et al. 1994, 1995).

Shrublands are lands dominated by woody, perennial vegetation with multiple stems growing from the base. With few exceptions, California shrublands comprise associations of *xerophytes*, or species adapted to arid conditions. Generally, four major shrubland formations are found in California: 1) southern coastal scrubs, 2) northern coastal scrubs, 3) chaparrals, and 4) San Joaquin Valley semidesert scrubs (Westman 1983, Barbour and Major 1988, Holland and Keil 1990, Sawyer and Keeler-Wolf 1995). These collectively account for approximately 15% of California's surface area (Holland and Keil 1990).

The convergence of massive human development and an especially diverse ecosystem has resulted in a concentration of shrubland species in peril of local or global extinction. One type of shrubland, coastal sage scrub, supports more than 100 species of plants and animals that are considered rare, sensitive, threatened, or endangered by California or U.S. federal wildlife agencies (Atwood 1993, McCaull 1994). Birds are arguably the most familiar and well-loved group of animals in shrubland habitats.

Photo by Eric Preston, ericpreston.com

Chaparral and coastal scrub habitats are among the most threatened and least protected of California habitat types.

The most profound factor that threatens shrubland birds is direct and permanent loss of habitat, which is most often the result of human land use, such as agriculture and residential development. Habitat loss directly affects the ability of an area to provide as much food, cover, and area as it did previously, thereby decreasing its ability to maintain the same population size of various species. The ramifications of this loss vary with species. The loss of ecosystem area and productivity may be manifested by a proportional reduction in population size or by more insidious effects such as reduced reproduction.

Habitat loss also contributes to increased fragmentation, and fragmented shrubland areas may not provide enough continuous acreage to support those bird species with the greatest area requirements (Lovio 1996). If fragments are sufficiently isolated, local "sub-populations" may eventually disappear through a combination of decreased survival, increased difficulty of recolonization after disturbance, and a reduction in genetic exchange over time.

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, introduces exotic species of plants and animals, and often contributes to unnaturally high fire frequencies. Other problems associated with burgeoning development include the creation of barriers to dispersal by juvenile birds and an increase in nest parasitism by Brown-headed Cowbirds. The gradual invasion of exotic vegetation, and in extreme cases, conversion of habitat from one type to another, has been documented in southern coastal scrub and chaparral (Alberts et al., unpublished data, ref. in Soulé et al. 1992). Such invasions occur after direct and indirect human disturbances such as mechanical habitat damage, an altered natural water regime, and increased fire frequency.

Mission and Objectives

The mission of Partners in Flight (PIF) is to stop the decline of, and 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. By developing the Coastal Scrub and Chaparral Bird Conservation Plan, CalPIF seeks to promote conservation and restoration of these habitats to support long-term viability and recovery of both native bird populations and other native species.

This is a plan for conservation of birds utilizing a subset of the natural shrublands of California: those low-elevation shrublands west of the state's major mountain axis. The goals of the Coastal Scrub and Chaparral Conservation Plan are:

- Emphasize what is needed to conserve both populations of species, and species assemblages, which are defined here as groups of naturally co-occurring bird species.

- Synthesize and summarize current scientific knowledge of the requirements of birds in shrubland habitats.

- Provide recommendations for habitat protection, restoration, management, monitoring, and policy to ensure the long-term persistence of birds and other wildlife dependent on shrubland ecosystems.

- Support and inform efforts to increase the overall acreage and effectiveness of shrubland habitat conservation efforts in California by funding and promoting on-the-ground conservation projects.

This conservation plan concentrates on a subset of coastal scrub and chaparral bird species, with the aim of contributing to the conservation of shrubland ecosystems as a whole. By focusing appropriate conservation efforts on a well-chosen suite of "focal" shrubland bird species, many other animals and plants may also benefit (Lambeck 1997). For example, demographic monitoring of bird species is especially valuable if those species serve as indicators of the presence of a threatened biological community (Chase et al. 2000), or are sensitive to a particular type of environmental change, such as habitat fragmentation (Noss 1990). Other species, especially those with large area requirements, may qualify as "umbrella species:" those whose protection will result in the protection of many other species (Noss 1990).

CalPIF recognizes that the subject of land management and land use, whether on private or public lands, can be contentious. Because so many threats to California shrublands, particularly in southern California, stem from conflicts between development and preservation, CalPIF encourages the increased communication and collaboration of local and state planners, developers, and conservationists to maximize the conservation benefits of mitigation required for development impacts. CalPIF supports and will seek to maximize the benefits of new and ongoing efforts, such as the Natural Communities Conservation Program, to ensure a critical level of coastal scrub and chaparral habitat is protected, monitored, and properly managed for future generations of Californians and wildlife.

Photo by Peter Knapp

Mountain Quail, a shrubland focal species.

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 low-elevation shrubland habitat types throughout the state, and
- develop biological conservation objectives for selected coastal scrub and chaparral bird species.

At more than 25 sites throughout California, monitoring data on coastal scrub/chaparral birds have been collected continuously over the past 10 years (some as long as 35 years). This document places an emphasis on a suite of 15 primary bird species chosen because of their conservation interest and to serve as focal species representative of the full range of low-elevation shrubland habitats in the state. Preliminary analyses of the 15 focal species' habitat requirements yield the following conservation recommendations:

- The preservation or protection of large blocks of coastal scrub and chaparral habitats is extremely important to maximize the long-term viability of many shrubland bird species in California. This is particularly true in areas already constrained by surrounding development.

- Connectivity between habitat patches is of key importance. For species such as the Cactus Wren, even small "stepping stone" patches connecting high quality habitat patches may function to facilitate juvenile dispersal and genetic exchange among subpopulations. Because some species, such as the California Gnatcatcher, have responded positively to revegetation in the past, habitat restoration near existing high-quality sites may be a workable solution for this problem in some cases.

- Buffers between development and protected habitat patches are important to minimize edge effects such as increased predation and invasion by exotic species. The type of buffer necessary will depend on the type of disturbance processes operating across reserve boundaries (Kelly and Rotenberry 1993).

- Fire should be managed to promote habitat conditions favorable to native species, which in most cases means extending the interval between fires to promote development of late seral stage habitat. Fuel management zones that decrease the risk of wildfire are an inescapable consequence of the need to protect human life and property in shrubland habitats. Narrower but more intensively managed fuel management zones should be favored over graded fuel reduction zones over a wide area.

- Restoration activities and other disturbances such as grazing, mowing, spraying, etc. in or near shrubland habitats should take place to the maximum extent possible outside the breeding season of native shrubland birds, which in California extends from March to mid-August.

- Because human activities constitute the single greatest threat to bird species in much of the state's coastal scrub and chaparral, increased collaboration between planners and conservationists is needed to minimize the deleterious effects of future development and maximize the benefits of conservation measures, e.g., bridges over canyons could be favored in place of building along canyon bottoms, and development could be directed to open space areas that have already been highly impacted (through invasion of exotics, soil compaction, etc.).

- The high number of sensitive, threatened, or listed species in coastal scrub and chaparral habitats, combined with the relative lack of demographic information on bird populations, makes the long-term viability of many shrubland species in California uncertain. Four of the 15 focal species are either locally extirpated or have experienced a reduction in their range. Extirpation may signal the early stages of a process of species or subspecies extinction. Research should be conducted to determine the factors associated with low reproductive success, and thus to identify which management and restoration actions will help 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. The monitoring of key species and key parameters such as nest success should be conducted, allowing management changes to be implemented before it is too late.

Chapter 1. Introduction

Conservation of Shrubland Birds

Native shrublands are a distinctive and integral part of the California landscape. Steep, brush-covered mountainsides, punctuated by the disembodied calls of quail and Wrentits, are part of the sense of place shared by many Californians. Indeed, the majority of California's population lives in the coastal region, where habitats such as chaparral and coastal scrub are a dominant feature of the natural landscape. The shrubland element of the California landscape also epitomizes the arid West in general, distinguishing it from other familiar American images, such as the mid-continental prairies or the eastern deciduous forests. The familiar shrubby backdrop to California's growing cities is a diverse and complex ecosystem that has evolved during a long history of ecological processes.

California habitats support an extraordinary diversity of plant and animal species, and shrublands are no exception. However, chaparral and coastal scrub habitats are among the most threatened and least protected of California habitat types (Davis et al. 1994, 1995). Massive human development and the presence of an especially diverse ecosystem have resulted in a concentration of species in peril of local or global extinction. One type of shrubland, coastal sage scrub, supports more than 100 species of plants and animals that are considered rare, sensitive, threatened, or endangered by California or U.S. federal wildlife agencies (Atwood 1993, McCaull 1994). Birds are arguably the most familiar and well-loved group of animals in shrubland habitats. Concern over the declines of several bird species, most notably the California Gnatcatcher, has led to greater efforts to conserve shrubland habitats in California.

Photo by Peter Knapp

The development of shrubland habitats led to the decline of many bird species, including the California Gnatcatcher.

Birds are important targets of conservation planning not only because they are relatively conspicuous and charismatic, but also because they can serve as indicators of the health of the larger ecosystem in which they reside. Through focusing appropriate conservation efforts on a well-chosen suite of "focal" shrubland bird species, many other animals and plants may also benefit (Lambeck 1997). For example, demographic monitoring of bird species is especially valuable if those species serve as indicators of the presence of a threatened biological community (Chase et al. 2000), or are sensitive to a particular type of environmental change, such as habitat fragmentation (Noss 1990). Other species, especially those with large area requirements, may qualify as umbrella species, i.e., species whose protection will result in the protection of many other species (Noss 1990). Thus, this conservation plan focuses on a subset of coastal scrub and chaparral bird species, with the aim of contributing to the conservation of shrubland ecosystems as a whole.

Conservation Plan Framework and Objectives

This is a plan for conservation of birds utilizing a subset of the natural shrublands of California. The geographic scope of this plan is based on the distribution of low-elevation shrublands west of the state's major mountain axis, as defined in detail in Chapter 2. Thus, the plan covers shrubland habitats occurring in the coastal bioregions of California plus the San Joaquin Valley, including coastal scrub, chaparral (with the exception of montane chaparral), and valley alkali desert scrub. In the future, we hope this plan will be expanded to include consideration of the entire geographic range of coastal scrub and chaparral habitats, including montane chaparral. The goals of CalPIF's Coastal Scrub and Chaparral Conservation Plan are:

- To emphasize what is needed to conserve both populations of species, and species assemblages, which are defined here as groups of naturally co-occurring bird species.

- To synthesize and summarize current scientific knowledge of the requirements of birds in shrubland habitats.

- To provide recommendations for habitat protection, restoration, management, monitoring, and policy to ensure the long-term persistence of birds and other wildlife dependent on shrubland ecosystems.

- To support and inform efforts to increase the overall acreage and effectiveness of shrubland habitat conservation efforts in California by funding and promoting on-the-ground conservation projects.

The Shrubland Conservation Plan is a dynamic "living" document, i.e., new information and data analysis will be incorporated into the recommendations and conservation targets regularly. This plan, combined with an associated Implementation Plan and ever expanding Geographic Information System (GIS), provides a foundation for adaptive conservation planning in California's shrubland habitats. In adaptive management, land managers implement science-based recommendations through their restoration and management activities and scientists monitor the consequent effects. As new data on the impact of management activities on wildlife and native plants become available, scientists revise recommendations and managers amend their work plans accordingly. Thus, scientists and managers create a steady feedback loop and consistently improve their methods for conserving native habitats and species.

This Conservation Plan is one of many to be created under the aegis of the national organization known as Partners in Flight (PIF), which seeks to protect North American landbirds throughout their ranges by reversing species declines, stabilizing populations, and "keeping common birds common." PIF is an international cooperative endeavor initiated in 1990 in response to alarming population declines noted among species of Neotropical migratory birds. The program encourages conservation through partnerships before species and their habitats become threatened or endangered and provides a constructive framework for guiding nongame landbird conservation activities throughout the United States, Canada, Mexico, and Central America.

California Partners in Flight (CalPIF) was formed in 1992 with the full participation of the state's land and wildlife managers, scientists and researchers, and private organizations interested in the conservation of nongame landbirds. Noting that the major cause of population declines in California appeared to be habitat loss and degradation, CalPIF identified critical habitats important to birds and worked cooperatively to protect and enhance remaining habitat fragments. CalPIF initially focused on riparian habitats, but has developed plans for several other ecosystems, including oak woodlands, grasslands, coniferous forests, shrubsteppe, and the Sierra Nevada, in addition to this coastal scrub and chaparral bird conservation plan (see http://www.prbo.org/calpif/plans.html for more information and current versions of these plans).

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Wildlife Conservation Service (WCS)
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Photo by Brian Sullivan

Chapter 2. Coastal Scrub and Chaparral Habitats in California

In a general sense, the distribution of California shrublands relative to other major vegetation formations is determined by temperature-moisture gradients (McMinn 1939, Major 1988). The largely unbroken mountainous spine, which includes the Cascades, Sierra Nevada, Transverse, and Peninsular Ranges is a major biogeographic boundary in California. The area west of this boundary, also referred to as "cis-montane," is influenced by the moderating effects of temperate, moist air from the Pacific Ocean. This Bird Conservation Plan (BCP) includes shrub-dominated plant communities within the Northwest Pacific Coast and Mediterranean-type climate regions of cis-montane California (Table 2-1).

This plan excludes montane shrublands occurring within the zone of coniferous forests that experience a climate of variable summer rain and snowy winters. The composition of both shrubland and avifaunal assemblages changes notably above this limit, which varies in elevation with latitude and longitude. McMinn (1939) regarded montane shrublands ecologically as "communities" of conifer forests rather than part of the chaparral formation. The avian assemblage associated with montane shrublands is distinctly different, though not mutually exclusive, from that found in the Mediterranean shrublands at lower elevations. Such montane shrubland bird species as Dusky Flycatcher (*Empidonax oberholseri*), Nashville Warbler (*Vermivora ruficapilla*), Black-throated Gray Warbler (*Dendroica nigrescens*), McGillvray's Warbler (*Oporornis tolmiei*), Green-tailed Towhee (*Pipilo chlorurus*), and Fox Sparrow (*Passerella iliaca*) are not included within the scope of this BCP (see Figure 2-1 for a map of the shrubland habitats covered by this plan). In the future, we hope the geographic scope of this plan will be expanded to include montane chaparral.

Major Shrubland Groupings

The vegetation associations that define the habitats considered in this plan are dominated by shrubs. Shrubs are defined as woody perennials with multiple stems growing from the base. With few exceptions, California shrublands comprise associations of *xerophytes*, or species adapted to arid conditions. More specifically, these shrublands are composed of *drymophytes*, which experience regimes of alternating short, wet seasons and long, dry seasons (McMinn 1939). Pure forms of these shrub associations do not include trees of any kind, although old individuals of some species may resemble and/or function ecologically as trees. Despite superficial similarities in general growth form, there are notable structural and physiological differences among the major shrubland formations. These differences, in turn, translate variably into habitat features of importance to birds.

Several major shrubland groupings are recognized by the California Wildlife Habitat Relationships System (CWHR). Those that occur primarily in the bioregions of California that are covered by this plan are: 1) coastal scrub, 2) chamise-redshank chaparral, 3) mixed-chaparral, and 4) San Joaquin Valley alkali desert scrub (Westman 1983, Barbour and Major 1988, Holland and Keil 1990, Sawyer and Keeler-Wolf 1995). These collectively account for 11- 15% of California's surface area (Holland and Keil 1990, Davis et al. 1998: Figure 2-1).

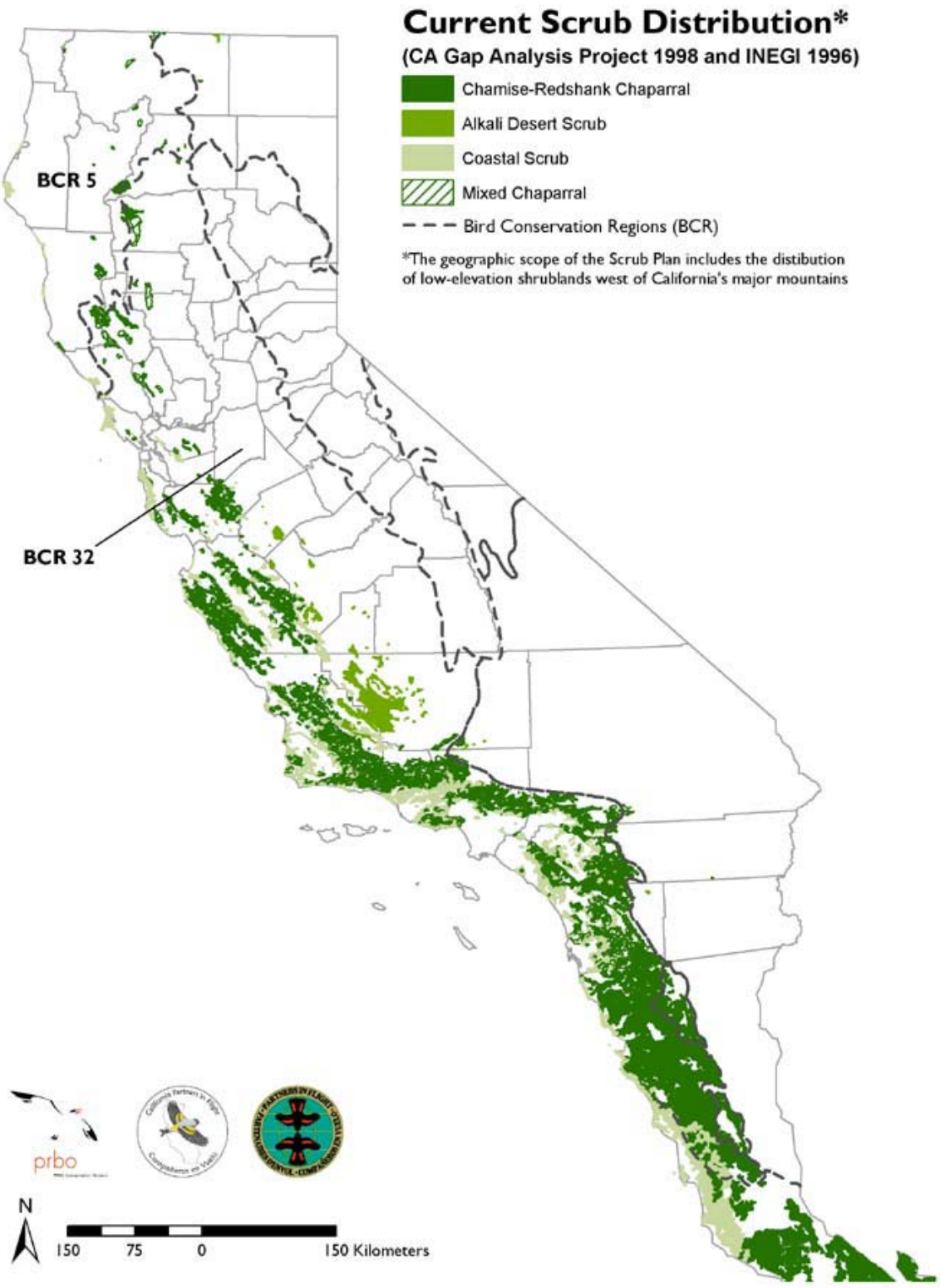


Figure 2-1. Current approximate coverage of coastal scrub and chaparral habitats in California and Baja

California covered by this plan, based on the California GAP Analysis Project (minimum mapping unit of 100 ha (1 km²); Davis et al. 1998). Potential coverage based on Kuchler (1976).

Coastal Scrub

It is useful to further subdivide coastal scrub habitats into northern and southern coastal scrub (NCS and SCS). Coastally restricted scrub in the southern half of the state is perhaps the most diverse and variable of all California shrublands. Southern coastal scrub resides along the coast between San Francisco and the Mexico border (Westman 1983). Heterogeneous structure and lower shrub density within the southern coastal scrub formation increase southward, as the coastal scrubs grade into Mexican coastal desert (McMinn 1939). Conversely, the evergreen element of coastal scrub increases toward the north (Mooney 1988).

Southern Coastal Scrub

California sagebrush (*Artemisia californica*) is perhaps the most widespread and characteristic constituent species of the SCS forms and occurs as an element of the northern coastal scrub as well. The other dominant element is an ecotypic replacement of true sages (*Salvia*) that may be more, less, or equally as important as California sagebrush in particular stands. Black sage (*S. mellifera*) predominates in the southernmost counties, although it extends to the San Francisco Bay Area (McMinn 1939). Because *S. leucophylla* prefers more mesic slopes (Westman 1983), purple sage (*S. leucophylla*) often dominates within its more restricted range between Orange and San Luis Obispo counties (McMinn 1939). These three dominant species are characteristically drought deciduous, but differ in other aspects of their phenologies: sagebrush blooms in fall and winter, whereas the true sages bloom in spring and summer. Typical co-dominant shrubs of southern coastal scrub include California buckwheat (*Eriogonum fasciculatum*), San Diego sunflower (*Viguiera laciniata*), coast bush monkeyflower (*Mimulus aurantiacus*), California encelia (*Encelia californica*), yellow bush penstemon (*Keckiella antirrhinoides*), laurel sumac (*Malosma laurina*), redberry (*Rhamnus crocea*), lemonade-berry (*Rhus integrifolia*), white sage (*Salvia apiana*), Mexican elderberry (*Sambucus mexicana*), and Mojave yucca (*Yucca schidigera*). Several shrub-forming cacti, particularly coastal cholla (*Opuntia prolifera*) and coastal prickly-pear (*O. littoralis*), lend a distinct structural element to many stands that is significant to birds.

Highly localized conditions of salt-laden wind, temperature, and fog-borne moisture in the immediate vicinity of the seashore support several coastal bluff communities that include widespread shrub species, but also distinct elements such as San Diego bursage (*Ambrosia chenopodiifolia*), cliff spurge (*Euphobia misera*), boxthorn (*Lycium californicum*), and saltbush (*Atriplex canescens*). The herbaceous elements of these associations often dominate (Holland 1986). Bluff scrub communities are often not far from maritime scrub communities supporting a relatively high diversity of succulents.

In addition to the gross structural characteristics of SCS, local, small-scale conditions often support non-shrub features that add to the structural diversity of the vegetation as bird habitat. Included are cryptobiotic crusts, which create open gaps of low, sparse herbaceous vegetation that are attractive to bird species such as the Lesser Nighthawk (*Chordeiles acutipennis*) (Lovio 1996); rock outcrops provide openness and associated herbaceous growth that favors other species such as the Rufous-crowned Sparrow (*Aimophila ruficeps*).

Northern Coastal Scrub

This most restricted form of coastal scrub occurs in a narrow strip from southern Oregon to approximately Point Sur, Monterey County (Heady et al. 1988, Mooney 1988). South of San Francisco Bay, NCS is patchily distributed and overlaps the northern range of SCS (Heady et al. 1988). It is less diverse than its southern counterpart, but is generally taller (one to two meters) and more dense, although it often includes large herbaceous openings (Munz and Keck 1959). It is mostly found below 150 meters elevation (Munz and Keck

1959). Physiognomically, NCS is distinguished from SCS by its lack of drought-deciduous species and by a well-developed, though variable herbaceous layer (Heady et al. 1988), which is apparently a consequence of relatively high annual rainfall (63 to 190 cm) and regular summer fog (Munz and Keck 1959).

Floristically, NCS is defined as an association of species also found in chaparral, but including several distinctively coastal species. Common co-dominants include such shrubs and sub-shrubs as coyote brush (*Baccharis pilularis*), lupine (*Lupinus variicolor* and *L. arboreus*), bush monkeyflower (*Diplacus aurantiacus*), poison oak (*Toxicodendron diversilobum*), and blackberry (*Rubus* spp.) (Munz and Keck 1959, Heady et al. 1988). NCS varies latitudinally in composition of both structural dominants and herbaceous components, but coyote brush is the one species that characterizes NCS throughout its distribution, forming a minor to nearly exclusive component along a generally south to north gradient (Heady et al. 1988). A lower, more open, and more restricted association dominated by subshrub-forming lupines is found on outer coastal bluffs in the central part of the range of this formation (Heady et al. 1988).

Photo by Eric Preston, ericpreston.com

An example of northern coastal scrub habitat.

NCS forms complex ecotones with several other vegetation formations, such as chaparral, SCS, grassland, and mixed evergreen forest (Heady et al. 1988). Long-term monitoring of permanent transects by McBride (1974) and McBride and Heady (1968) in Alameda County revealed a seral sequence among coastal prairie (grassland), NCS, and mixed evergreen forest. This supports the hypothesis that NCS has a mid-seral status in a complex disturbance system mediated by fire and various forms of mechanical disturbance of mostly anthropogenic origin.

The distributions of a few bird species correspond highly with NCS. Most notable are the sedentary and migratory races of the White-crowned Sparrow (*Zonotrichia leucophrys nuttallii* and *Z. l. pugetensis,* respectively). The Allen's Hummingbird (*Selasphorus sasin*) and north coastal race of the Orange-crowned Warbler (*Vermivora celata lutescens*) are also associated with this formation, but are not found solely in scrub vegetation.

Chaparral

Chaparral is the most widespread shrub formation in California and is composed mostly of relatively tall (one to five meters), woody shrubs with drought-resistant leaves and winter growing seasons (McMinn 1939, Hanes 1988). Although distributed from southern Oregon to Northern Baja California, chaparral attains its greatest extent in the southern half of California, where it maintains an intermediate position (physiologically and geographically) between more xeric scrubs and grasslands and more mesic woodlands (McMinn 1939). Chaparral is drought and fire-adapted, typically flourishing on steep slopes with porous, nutrient-poor, rocky soils (Hanes 1988). The continued, cyclic recovery of chaparral after millenia of both natural and anthropogenic fires in a state with high potential for invasion by alien species is testimony to the resilience of this ecosystem.

Hanes (1988) distinguished ten types of chaparral associations and presented a general, functional classification that links basic floristic groups with aspect, elevation and disturbance. Four of Hanes' ten types are not considered in this plan, as they occur either at high elevations, are structurally related to woodlands, or occur only on the Channel Islands. The six types considered in this plan include chamise chaparral, *Ceonothus* chaparral, scrub-oak chaparral, redshank chaparral, serpentine chaparral and desert chaparral. These types have also been grouped into two more general associations: chamise-redshank chaparral and mixed chaparral (CWHR).

Where chamise (*Adenostoma fasciculatum*) or redshank (*Adenostoma sparsifolium*) are the dominant species, chaparral may be classified as chamise-redshank chaparral (see CWHR for more detailed criteria to distinguish chamise-redshank chaparral from other chaparral types). Chamise-redshank chaparral generally occurs at lower elevations and grades into mixed chaparral at higher elevations. Chamise is the most widespread component species in chaparral habitats, representing a common element among all the types and ranging from an exclusive dominant to a minor component. Chamise-dominated chaparral apparently represents the xeric end of the range of component species, as it often occurs in near-monocultures on lower, more exposed, and/or steeper slopes (Hanes 1988). Shrub species commonly associated with chamise-redshank chaparral include toyon (*Hetromeles arbutifolia*), sugar sumac (*Rhus ovata*), manzanita (*Arctostaphylos* spp.), scrub oak (*Quercus* sp.), laurel sumac (*Malosma laurina*), poison oak, ceanothus, white sage, black sage, and California buckwheat.

The plant species composition of mixed chaparral varies geographically, with dominant species including scrub oak, chaparral oak, and several species of ceonothus and manzanita. Serpentine chaparral has several species in common with other types of mixed chaparral, but is usually lower in stature, more open in growth form, and supports several endemic species adapted to the harsh soil. Manzanita is a component of higher elevation chaparrals, but attains a higher level of importance in montane associations not considered by this plan. Other species commonly associated with mixed chaparral include birchleaf mountain mahogany (*Cercocarpus betuloides*), silk-tassel (*Garrya congdonii*), toyon (*Heteromeles arbutifolia*), yerba santa (*Eriodictyon californicum*), California buckeye (*Aesculus californica*), and poison oak.

Despite the relatively uniform physiognomy of chaparral throughout its range, there are unusual, often restricted floristic mixes and edaphic (local, soil related) conditions that contribute to anomalous structural types that may provide additional elements or diversity for bird assemblages. As mentioned above, serpentine chaparral is generally low in stature, but in some areas of this unusual soil type the endemic sargent cypress (*Cupressus sargentii*) adds atypically tall structure so as to increase overall heterogeneity (Hanes 1988). Ecotonal chaparral may include small individuals of species from adjacent woodland types such as oaks (*Quercus* spp) and pinyon (*Pinus monophylla*) (Hanes 1988). Several other restricted species of cypress occur in localized admixtures with dense chaparral in several southern California mountain ranges, adding distinct structural

elements to the vegetation (Holland 1986). Other areas with harsh edaphic conditions do not support unique floristic elements, but do result in open, "dwarf" scrubs that provide for bird species favoring these conditions.

San Joaquin Valley Alkali Desert Scrub

The western and southern portions of the San Joaquin Valley are typified by extremely harsh environmental conditions; soils are poorly drained and therefore highly alkaline, and the climate is classified as desert, where evapo-transpiration exceeds rainfall. A collection of low-growing, generally open shrublands composed of subshrubs and much herbaceous cover occurs on flats, low slopes and ridges surrounding the San Joaquin Valley. These varied, but structurally simple vegetation associations with low shrub diversity are perhaps the most heavily altered and historically replaced of all the California shrublands due to intensive agriculture and grazing in this part of the state (Holland 1986).

In the CWHR system, San Joaquin alkali desert scrub is grouped with other alkali scrubs occurring predominantly in the desert bioregions. Holland (1986; pp 18-20) describes four associations of sink/saltbush scrub along the western, eastern, and southern edges of the San Joaquin Valley and formerly extending into part of Sacramento Valley. Agriculture, flood control, groundwater pumping, and grazing have largely extirpated two of these associations. Valley sink scrub, valley saltbush scrub, and Interior Coast Range saltbush scrub can still be found in small areas of the San Joaquin Valley and adjacent Coast Ranges.

The alkali desert scrubs are variably open and interspersed in mosaics with similarly adapted herbaceous vegetation (Heady 1988). Characteristic subshrub species of the alkaline associations include iodine bush (*Allenrolfea occidentalis*) and rusty molly (*Kochia californica*). Higher, drier, non-saline soils support allscale (*Atriplex polycarpa*) and mormon tea (*Ephedra californica*) (Holland 1986, Heady 1988, Rowlands 1988). Some of the more elevated semi-desert scrubs experience very arid conditions, as they are typically above the level of tule fog.

Further Classification

While recognizing the importance of broad classification schemes (e.g., CWHR), Sawyer and Keeler-Wolf (1995) provided a more detailed classification system for vegetation in California. Their system allows for classification at a more specific level; floristically based on lower units of plant associations (referred to as series). A single, widely accepted terminology provides land managers, natural resources specialists, and conservationists with a common language that promotes clear communication and better-informed decisions.

CalPIF has adopted the Sawyer and Keeler-Wolf system (SKW) of vegetation classification as the standard used for all CalPIF objectives. With a standardized classification system we can describe vegetation associated with many aspects of bird biology and conservation across space and time. The SKW system ties in with continental planning efforts of The Nature Conservancy and is compatible with most previous schemes used in California, such as those already outlined. Coastal scrub habitats include 25 series defined by SKW, all of which are considered in this plan. Chamise chaparral includes 13 SKW series, mixed-chaparral includes 37 SKW series, and alkali desert scrub includes 13 SKW series; however, only those series found in the coastal and San Joaquin Valley regions of California are considered in this plan.

Comparison of Shrubland Groupings

The northern and southern coastal scrubs represent a continuum, from domination by evergreen species in the north to drought-deciduous and succulent species in the south (Mooney 1988). Southern coastal scrubs generally segregate from the relatively wetter chaparral to coastal scrub, which occurs on lower, drier slopes (Harrison et al. 1971). Southern coastal scrub is typically associated with 25 – 38 cm (10 – 15") of rain annually, whereas chaparral usually experiences up to 76 cm (30"). More than 80% of this rainfall occurs in the period between late fall and early spring for both shrub formations (McMinn 1939). Chaparral shrubs are generally more deeply rooted than sage scrub and are more resistant to frost, which has ramifications for seasonal growth patterns and relative distributions (Hanes 1988, Mooney 1988). Sage scrub is able to make more efficient use of early and low amounts of rainfall by having more root biomass near the surface of the soil (Mooney 1988). As a result, annual growth of sage scrub typically begins shortly after (or even before) the onset of fall-winter rains, whereas that of chaparral takes place in the spring, after the soil is saturated (Mooney 1988).

Coastal sage scrub and chaparral shrubs differ in ways that are likely of direct and indirect importance to birds. Most sage scrub species direct proportionately more energy and materials to leaf growth than to woody biomass (Mooney 1988), which in combination with relatively more xeric conditions typically results in a lower, more open growth form that provides more open ground and herbaceous cover. The same open structure is temporarily attained by post-fire chaparral and is of importance to bird species such as the Sage Sparrow (*Amphispiza belli*) (Lovio 1996, USDA Forest Service 1997). Although chaparral maintains more photosynthesis during the dry summer months, its year-long photosynthetic rate is lower than that of sage scrub due to a significantly higher seasonal peak of primary productivity in the winter and spring by the latter (Mooney 1988). In terms of trophic productivity, sage scrub is more highly seasonal than chaparral, but may be intermediate between chaparral and certain herbaceous types such as grasslands. Furthermore, sage scrub leaves contain notably higher amounts of certain nutrients important to herbivorous insects than do those of chaparral shrubs (Mooney 1988). The period of peak production of nutrient-rich foliage coincides with the peak of the bird breeding season in California's Mediterranean shrublands. Repeated anecdotal observations of riparian bird species foraging in sage scrub during the spring months (Lovio unpub. obs.) suggest that the copious foliage of this vegetation type may form the basis of an important food resource, and may be periodically more productive in the fall than riparian vegetation, which typically achieves its peak productivity in summer.

A seral relationship between coastal scrub and chaparral has been proposed by some authors (review in Hanes 1988). Southern California is the region where the interface between these formations is the most extensive and complex. Confounding factors such as aspect, microclimate, time since last disturbance, and coastal proximity may cause local distributions of these types that defy some of the generalities stated above. There are examples of areas of local disturbance in chaparral areas that support development of sage scrub, which has intriguing implications for the source of sage scrub propagules under these conditions. Harrison et al. (1971) suggest that sage scrub may have a post-disturbance advantage by virtue of faster growth rates and smaller, wind-dispersed seeds. The eventual replacement of sage scrub by chaparral, however, has not been well documented. There are perhaps few cases of such disturbances being observed over many decades. Furthermore, there are many documented cases of disturbed coastal scrub and chaparral recovering directly back into the original respective vegetation types, with no intermediate seral stages. It is likely that the seral relationship between these formations is relegated to the complex zone of transition.

Table 2-1. Approximate current coverage by bioregion (in hectares) of coastal scrub and chaparral habitat types based on the California GAP Analysis Project 1998[a].

	Klamath	Bay/Delta	San Joaquin	Central Coast
Chamise-Redshank Chaparral	63,101	62,048	8933	444,400
Mixed Chaparral	99,369	37,494	22,271	413,469
Coastal Scrub	14,127	60,795	44,703	197,470
Alkali Desert Scrub	0	0	209,494	13,865
Percent Covered by Scrub/Chaparral	**2.7%**	**7%**	**10.2%**	**35.9%**

	South Coast	Total 5 Bioregions[b]	Total Statewide[b]
Chamise-Redshank Chaparral	420,231	998,713	1,186,200
Mixed Chaparral	431,856	1,004,459	1,290,849
Coastal Scrub	343,968	661,063	670,974
Alkali Desert Scrub	0	223,359	1,490,140
Percent Covered by Scrub/Chaparral	**45.2%**	**16.7%**	**11.4%**

[a] Davis et al. (1998).

[b] The *Total-5 Bioregions* column is the hectare coverage and percentage for the 5 bioregions covered in this plan. *Total-Statewide* includes all 10 bioregions, including the Modoc, Sierra, Mohave and Colorado Desert Bioregions (which contain scrub habitats not included in this plan), and the Sacramento Valley Bioregion (which lacks scrub habitat).

Chapter 3. Conservation Planning Process

The Coastal Scrub/Chaparral Bird Conservation Plan has been developed collaboratively by leading bird researchers in California through a process designed to:

- Capture the conservation needs of the complete range of cis-montane scrub habitat types throughout the state.
- Develop, by consensus, biological conservation objectives for selected scrub bird species.

Criteria for Selecting Coastal Scrub/Chaparral Focal Species

The majority of the PIF planning efforts use the national PIF database (Carter et al. 2000) to prioritize species in need of conservation attention and then select focal species by region or habitat for conservation plans. California Partners in Flight elected against this method for the Coastal Scrub and Chaparral Bird Conservation Plan for a number of reasons. The national PIF prioritization scheme, because it focuses on a national scale, heavily emphasizes endemism. At the same time, the database fails to recognize many subspecies, such as the western Yellow-billed Cuckoo, a California endangered species. These factors render such a "priority" species list less representative than CalPIF desired. Instead, CalPIF chose to emphasize the ecological associations of individual species *as well as* those of conservation concern (Chase and Geupel *in press*). In doing so, CalPIF included a suite of focal species whose requirements define different spatial attributes, habitat characteristics, and management regimes representative of a "healthy" system (Table 3-1). While CalPIF recognizes the utility of the national prioritization scheme and provides additional data to improve its accuracy regarding California's birds, it recommends using the list as a guide for conservation priorities rather than a formula for conservation spending.

California Partners in Flight included species in the conservation planning process based on five factors (although not all species meeting these criteria were selected). The species considered:

- Use coastal scrub or chaparral vegetation as their primary breeding habitat in most bioregions.
- Warrant special management status—endangered, threatened, or species of special concern on either the federal or state level.
- Have experienced a reduction from their historical breeding range.
- Commonly breed throughout California's coastal scrub or chaparral areas—allowing adequate sample sizes for statistical comparisons and therefore the ability to rapidly assess responses to changes in management (such as restoration).
- Have breeding requirements that represent the full range of successional stages of coastal scrub and chaparral ecosystems.

Because birds occupy a wide diversity of ecological niches, they serve as useful tools in the design of conservation efforts. 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. Therefore, the assumption is that a landscape designed and managed to meet the focal species' needs encompasses the requirements of other species (Lambeck 1997).

Key findings from the species accounts are available at http://www.prbo.org/calpif. These findings and the detailed information found in each species account provide the basis for the conclusions and conservation recommendations presented in this Conservation Plan. Account authors and other conservation and land management experts gathered to discuss and synthesize their results into a summary of concerns, habitat requirements, conservation objectives, and action plans (or recommendations). The species accounts and the results from this meeting form the backbone of this Conservation Plan.

Focal Species Conservation

The species presented in Table 3-1 were selected to serve as focal species for assessment of trends, risks, habitat requirements, and for prescription of specific conservation measures. This subset of bird species collectively represents the range of geographic and seral conditions of shrublands considered by this plan. Primary species are defined by one or more of the following criteria: predominantly or exclusively associated with at least one shrubland association or phase thereof; documented or strongly suspected as declining; and/or naturally rare or restricted in range. The primary list includes several distinct races or populations of species that are otherwise common, widespread, and not found in the vegetation associations considered by this plan. The secondary list includes species meeting one or more of the following criteria: common and widespread; having a greater breadth of habitat tolerances that includes non-shrubland types; and/or are addressed by other Bird Conservation Plans. Figures 3-1 through 3-12 show current range, study sites and breeding status at these sites for several of the primary focal species. On these maps, you can see how these ranges relate to the coverage of coastal scrub and chaparral habitats covered by this plan (Davis 1998).

Photo by James Gallagher, Sea and Sage Audubon

The Sage Sparrow was selected as a primary focal species for this plan.

Data-Gathering Effort

Identifying population fluctuations requires an understanding of how demographic and physiological processes (i.e., annual survival, reproductive success, dispersal, and recruitment) vary across habitats, landscapes, and management practices. This information must be gathered using scientifically sound research and monitoring techniques (see Appendix B for a summary or Ralph et al. 1995 for review). Until recently, the Breeding Bird Survey (BBS), coordinated by the USFWS and the Canadian Wildlife Service produced most of the available information regarding changes in the sizes and ranges of landbird populations in North America (Sauer et al. 1999). These roadside counts provide an excellent baseline by which to assess long-term population trends, but they do little to identify the habitat and landscape variables contributing to these changes and fail to adequately monitor bird populations away from roads and human disturbance. The inability of BBS data to detect trends within certain habitats, particularly patchily distributed habitats, contributes to the need for more intensive, site-specific monitoring techniques.

Using standardized methods, biologists throughout California have contributed data to this document. Contributors have sent information garnered from constant-effort mist netting, nest searching, and point counts. Because techniques are standardized, they may be compared across projects and over time.

Table 3-1. Ecology, status, special factors, and risks for primary and secondary focal shrubland species.

Species	Primary (1°) or Secondary (2°) Species	Habitat Association[1]	Statewide Status[2]	Reliable BBS trend?[3]	Historical Breeding Range by Bioregion[4,5]	Special Factors[7]	Nest Site[6]
Mountain Quail *(Oreortyx pictus)*	1°	SWF	Naturally sparse; no shrinkage of historical range. Game species. SED	No (1)	Klam*, Modo*, Sier*, Ba/De, CeCo (higher elev), SoCo, MojD* (N mtns)	Requires vast, undisturbed, unfragmented shrubland-woodland-forest mosaic. Possibly sensitive to fragmentation and human presence.	Ground
Greater Road-runner *(Geococcyx californianus)*	1°	SHG	Naturally sparse, especially in north part of range. Extirpated from portions of their former range. SED	No (1)	Sier*, Sacr, SanJ, MojD*, ColD*, SoCo, CeCo > Ba/De, Klam	Secluded nesting site. Tolerant of human presence, but negatively affected by intense development. Apparently limited in north by extensive dense brush.	Large dense shrub or cactus
Lesser Nighthawk *(Chordeiles acutipennis)*	1°	SHG	Naturally sparse; possibly extirpated from northern part of range (CenCo & north CenV). MIG	No (2)	SoCo, MojD*, ColD*, SanJ > CeCo, Sacr, Sier* (Great Basin)	For nesting: undisturbed, level, naturally open veg. with cobble or cryptobiotic crust on mesas, washes, playas. Wide range of forage habitats.	Ground
Common Poorwill *(Phalaenoptilus nutallii)*	1°	SWF	PMIG	No (1)	Sier (Great Basin*), Klam (south), Modo (south), Ba/De, CeCo, SoCo, ColD*, MojD*	Eggs usually laid on bare ground. A slight hollow may be scraped in the bare earth.	Ground
Costa's Hummingbird *(Calypte costae)*	1°	UG-CS	PMIG	Yes*	ColD*, MojD*, SoCo > CeCo, Sier (Great Basin south)*	Shrublands. Flowering plants (native & non-native).	Xeric shrub, often near water
Cactus Wren *(Campylorhynchus brunneicapillus) sandiegensis)*	1°	SS-CS	State Species of Special Concern. SED	No (1)	ColD*, MojD*, SoCo	Moderate to large shrub-forming cactus stands.	Cactus
California Gnatcatcher (*Polioptila californica)*	1°	SS-CS	Federally threatened. SED	No (1)	SoCo	Moderate to low coastal scrub. Tolerant of moderate fragmentation. Coastal to inland gradient of increasing home range size.	Low shrub

Table 3-1 cont.

Wrentit (*Chamaea fasciata*)	1°	UG	Widespread and common. SED	Yes	Klam, Modo (foothills), Ba/De, Sier (foothills), Sacr, SanJ, CeCo, SoCo	Tolerant of human edges and small patch sizes.	Shrub
Le Conte's Thrasher *(Toxostoma lecontei)*	1°	SHG	SED	Yes*	Sier (Great Basin south)*, MojD*, ColD*, SanJ (south)	Prefers thick, dense, and thorny desert shrubs or cholla for nesting.	Shrub
Gray Vireo (*Vireo vicinior)*	1°	SWF	Sparse, highly disjunct breeding grounds. MIG	No (1)	MojD* (mtns), SoCo, CeCo, Sier*	Requires vast, undisturbed, tall, dense shrublands.	Shrub
Rufous-crowned Sparrow (*Aimophila ruficeps*)	1°	SHG	Widespread and common. SED	No (2)	Sier (foothills), SoCo, CeCo > MojD* (mtns), Ba/De, Sacr (Sutter Buttes), SanJ (south)	Moderately tolerant of acute veg. disturbance and not overly sensitive to fragmentation.	Ground w/ dense herb or under shrub
Black-chinned Sparrow *(Spizella atrogularis)*	1°	SS	Locally sparse to common, but highly disjunct range. SED	No (2)	CeCo, SoCo, Ba/De, Sier (foothills, Great Basin*), MojD* (mtns)	Requires undisturbed brush. Prefers slopes away from coast. Fragmentation-sensitive.	Low shrub
Sage Sparrow (*Amphispiza belli canescens)*	1°	SS	PMIG	Yes*	MojD* (north), Sier* (southeast, Great Basin south), SanJ, CeCo (E slopes)	Nests in saltbush (*Atriplex* spp.) or rabbitbush (*Chrysothamnus* spp.).	Low shrub
Sage Sparrow (*Amphispiza belli. belli)*	1°	SS	Former federal category 2. Declining in Coast Ranges. SED	Yes*	SoCo, CeCo, Ba/De and Klam (E slopes), Sier (foothills)	Requires extensive, low, open brush. Can tolerate herbaceous mosaic. Very fragmentation sensitive. May be socially facilitated.	Low shrub
Nuttall White-crowned Sparrow *(Zonotrichia leucophrys nuttalli)*	1°	SS	SED	Yes	Klam, Ba/De, CeCo	Place nests in a variety of shrubbery in urban areas, but tend to use coyote bush (*Baccharis*), sage (*Artemisia*), and berry (*Rubus*) brambles along coastal chaparral.	Low shrub
Turkey Vulture *(Cathartes aura)*	2°	SWF	PMIG	No (1)	Statewide except for highest parts of mountains	Lays eggs in dark recesses in great variety of sites: in rock outcrops, including ledges, caves, and crevices, and among tumbled boulders.	Cave or ledge on brushy slope
California Quail *(Callipepla californica)*	2°	SWF SHG	Widespread and common. SED	Yes	Statewide except for higher Sierra, most of MojD* (occurs on Mojave River), ColD	Fairly tolerant of habitat disturbance and human habitat.	Ground

Table 3-1 cont.

Allen's Hummingbird *(Selasphorus sasin)*	2°	SWF	Sparse, but stable. Possibly expanding E in San Francisco Bay region. PMIG	No (2)	Klam, Ba/De, CeCo, SoCo (north end)	Breeding males and females have different habitat preferences. Males prefer open areas of coastal scrub or riparian shrubs. Females select nests in more densely vegetated areas with at least some tree cover.	Shrub or tree
Western Scrub-Jay *(Aphelocoma californica)*	2°	SWF	Widespread and common. SED	Yes	Statewide except for most of MojD* and ColD.	Facilitated by human landscape alterations.	Shrub or tree
Bewick's Wren *(Thryomanes bewickii)*	2°	SWF	Widespread and common. SED	Yes	Statewide except for higher elev Modo & Sier, lower elev MojD* & ColD.	Tolerant of human edges and small patch size.	Natural or man-made cavity
Blue-gray Gnatcatcher *(Polioptila caerulea,*	2°	SWF	Widespread and sparse. PMIG	No (2)	Klam, Modo, Sier (foothills and Great Basin*), Ba/De, CeCo, SoCo, MojD* (mtns)	Requires large, unfragmented, undisturbed areas.	Shrub or tree
California Thrasher *(Toxostoma redivivum)*	2°	UG	Widespread and sparse. SED	Yes	Klam, Modo (south), Sacr, SanJ, Sier (foothills), Ba/De, CeCo, SoCo	Low density. Prefers tall, mature, undisturbed shrub growth and riparian scrub, but tolerant of small patch sizes.	Shrub
Common Yellowthroat *(Geothlypis trichas)*	2°	UG-W	Widespread and common. PMIG	No (2)	Statewide except for higher Sier and non-wetland areas of MojD* & non-wetland ColD*	An inhabitant of thick, tangled vegetation.	Ground
Spotted Towhee *(Pipilo maculatus)*	2°	UG	Widespread and common. PMIG	Yes	Statewide except for crest of Sier, lowland MojD* and ColD	Prefers tall, dense shrublands.	Ground > low shrub
California Towhee *(Pipilo crissalis)*	2°	SWF SHG	Widespread and common. SED	Yes*	Klam, Modo (localized), Ba/De, Sacr, SanJ, Sier (foothills), CeCo, SoCo,	Classified as insensitive to habitat edge/fragmentation resulting from urban and rural development.	Shrub or tree
Song Sparrow *(Melospiza melodia)*	2°	UG-W-CS	Widespread and common. PMIG	Yes*	Statewide except for higher Sier, non-wetland MojD* & non-wetland ColD*	Coastal scrub on seaward slopes, adjacent to large reservoirs, or in canyon bottoms with mesic veg. Tolerant of high herbaceous component from disturbance.	Low shrub

[1] Habitat Asociations: Species are classified by range of structural vegetation types used in the breeding season: SS = shrubland specialist; CS = coastal scrub specialist; UG = understory generalist; SWF = shrubland-woodland-forest; SHG = shrubland-herbaceous-grassland; W = wetland affinity.

[2] Seasonal status: MIG = migratory, PMIG = partially migratory, SED = sedentary.

[3] BBS reliability defined using BBS credibility codes for the entire state of California: (1) = data with important deficiency, (2) = data with deficiency. See http://www.mbr-pwrc.usgs.gov/bbs/cred.html for details. However, BBS trends may still be unreliable within a specific physiographic region of California. An * indicates that although BBS data on the focal species is reliable for the entire state, the subspecies or populations considered under this plan may not be monitored reliably.

[4] Ranges obtained from Grinnell and Miller (1944)

[5] Bioregions (north to south): Breeding ranges for California are given irrespective of race or population. Bioregions adapted from California Biodiversity Council (RAC 1998). Klam = Klamath, Modo = Modoc, Sier = Sierra, Ba/De = Bay Area / Delta, Sacr = Sacramento Valley, SanJ = San Joaquin Valley, CeCo = Central Coast, MojD = Mojave Desert, SoCo = South Coast, ColD = Colorado Desert. * = distribution of races or populations not considered under this plan. > = distinguishes major from minor populations.

[6] General nest references:
Harrison, C. 1978. A field guide to the nests, eggs, and nestlings of North American birds. The Stephen Greene Press, Brattleboro, Vermont.
Harrison, H.H. 1979. A field guide to western birds' nests. Houghton Mifflin Co., Boston.

[7] Special Factors: Some information taken from the Birds of North America series (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.

Photo by Eric Preston, ericpreston.com

California Quail was selected as a secondary focal species for this plan.

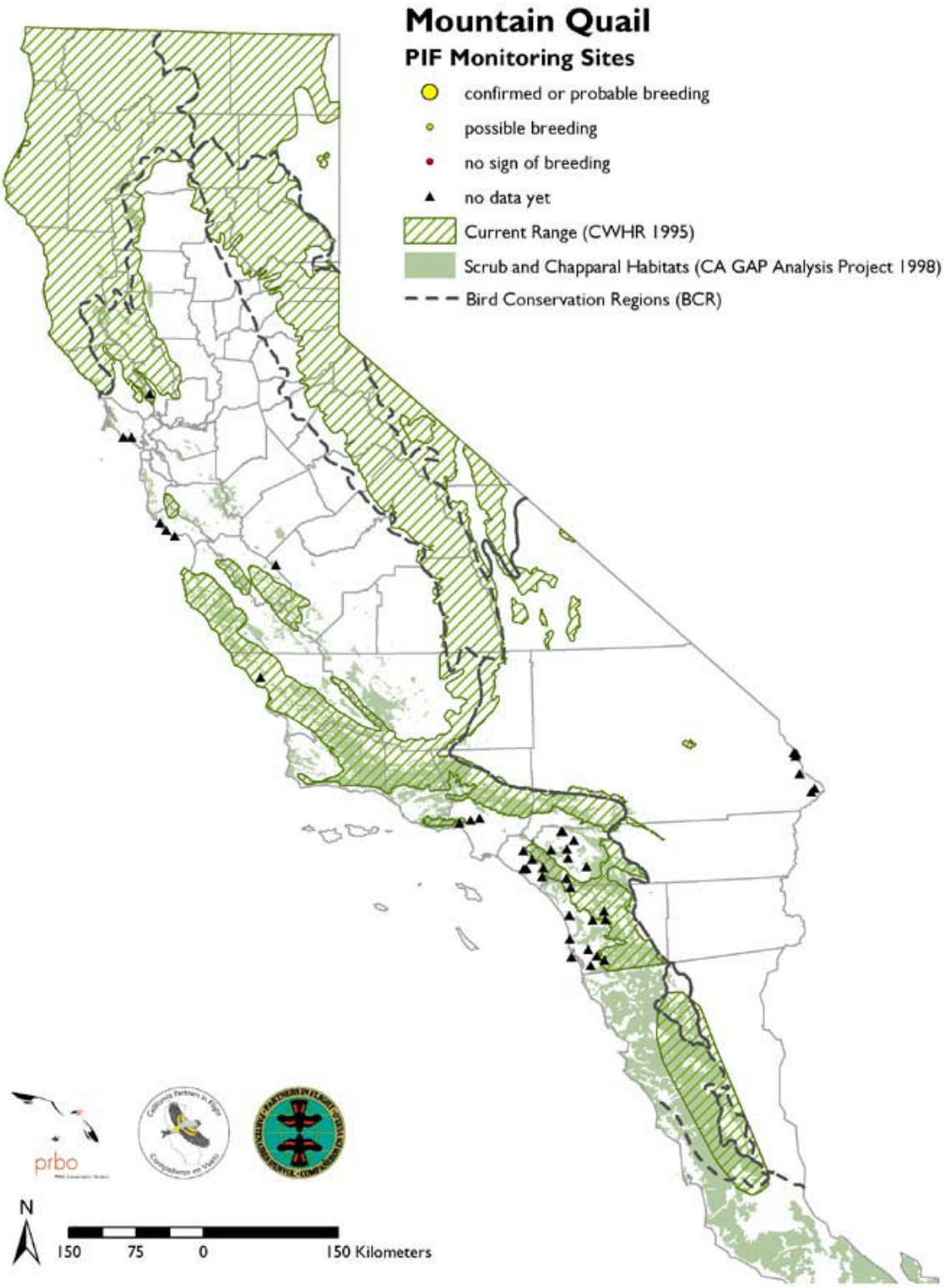


Figure 3-1. PIF monitoring sites, breeding status at these sites, and current range for the Mountain Quail.

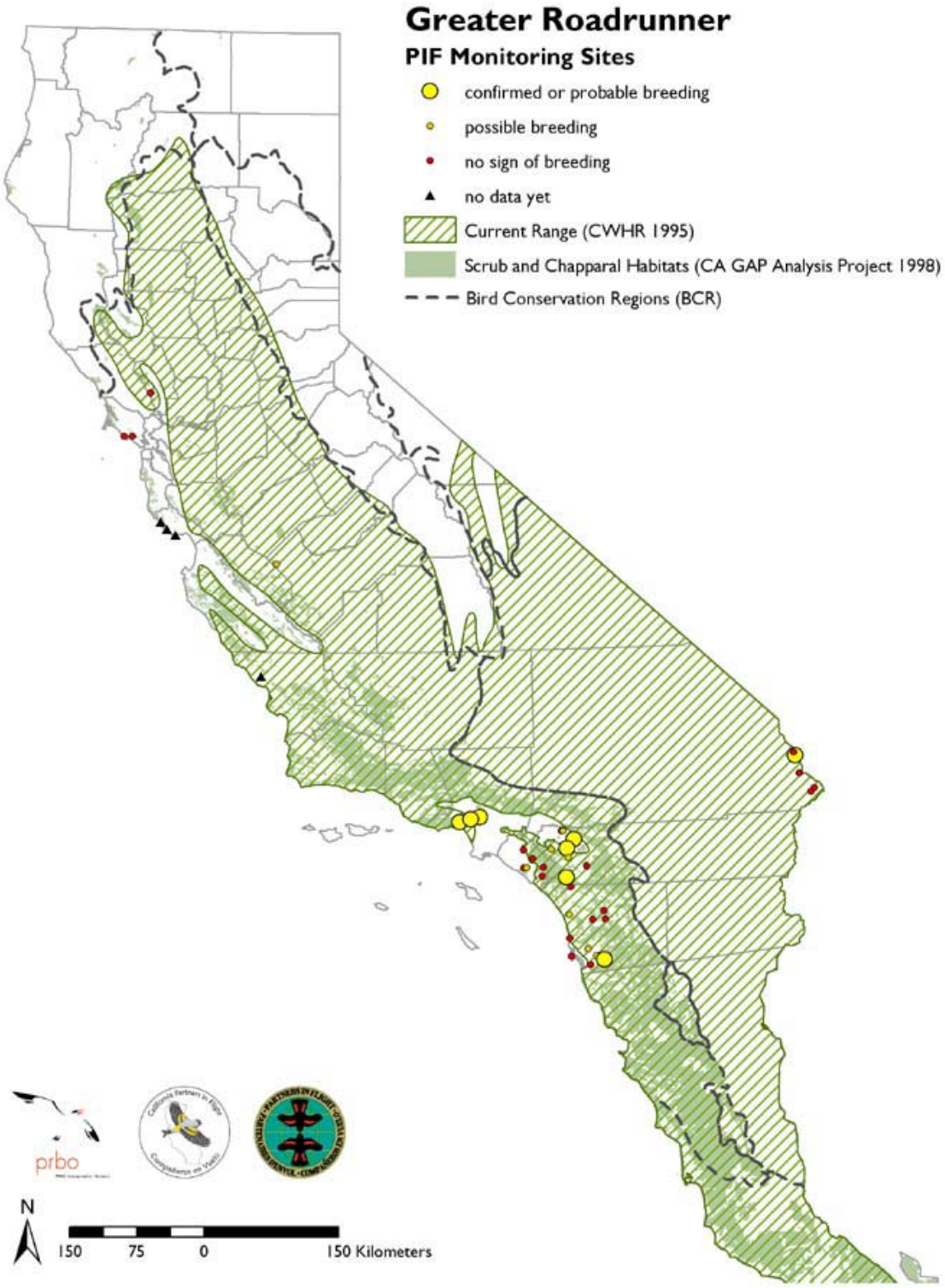


Figure 3-2. PIF monitoring sites, breeding status at these sites, and current range for the Greater Roadrunner.

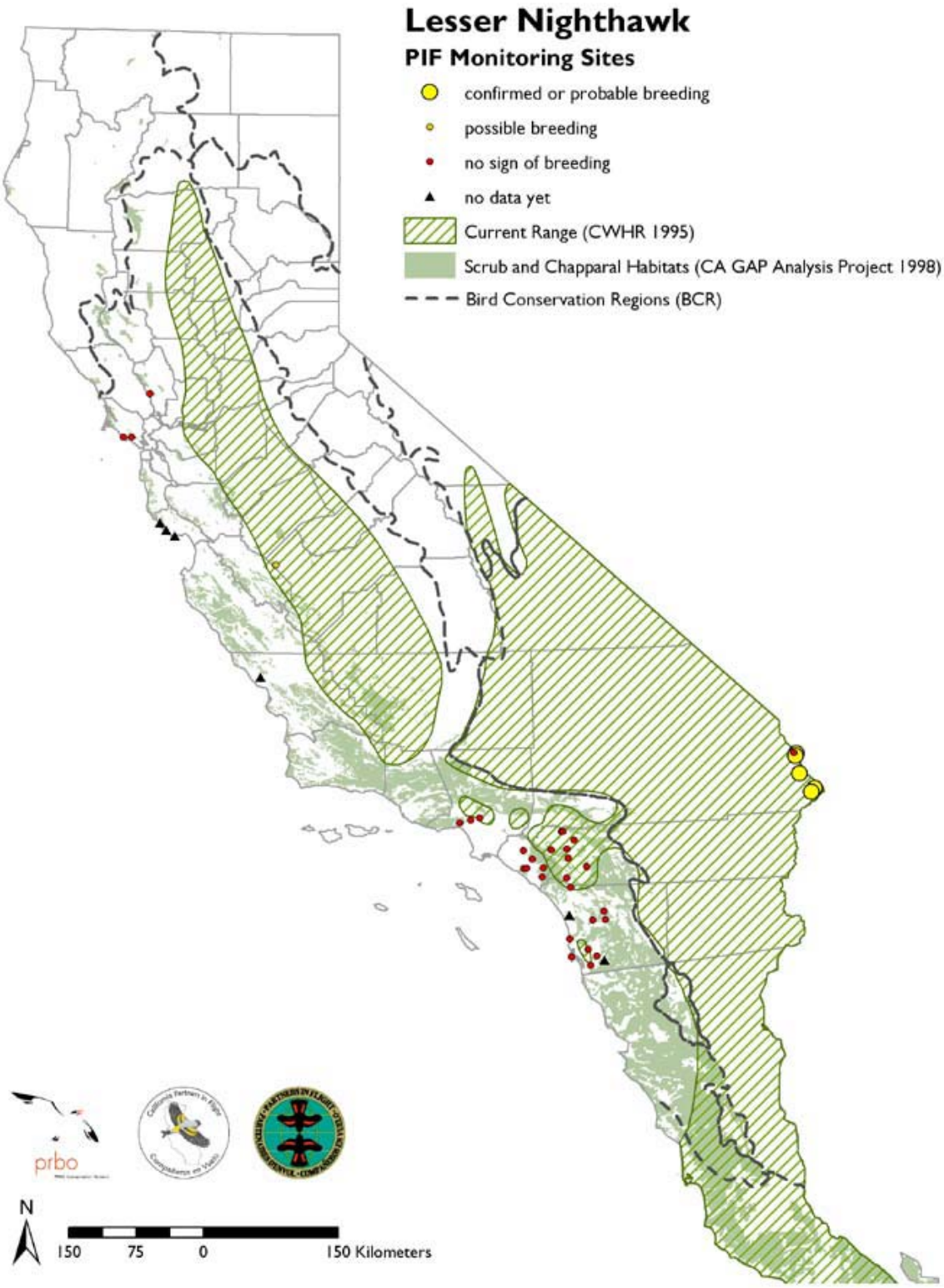


Figure 3-3. PIF monitoring sites, breeding status at these sites, and current range of the Lesser Nighthawk.

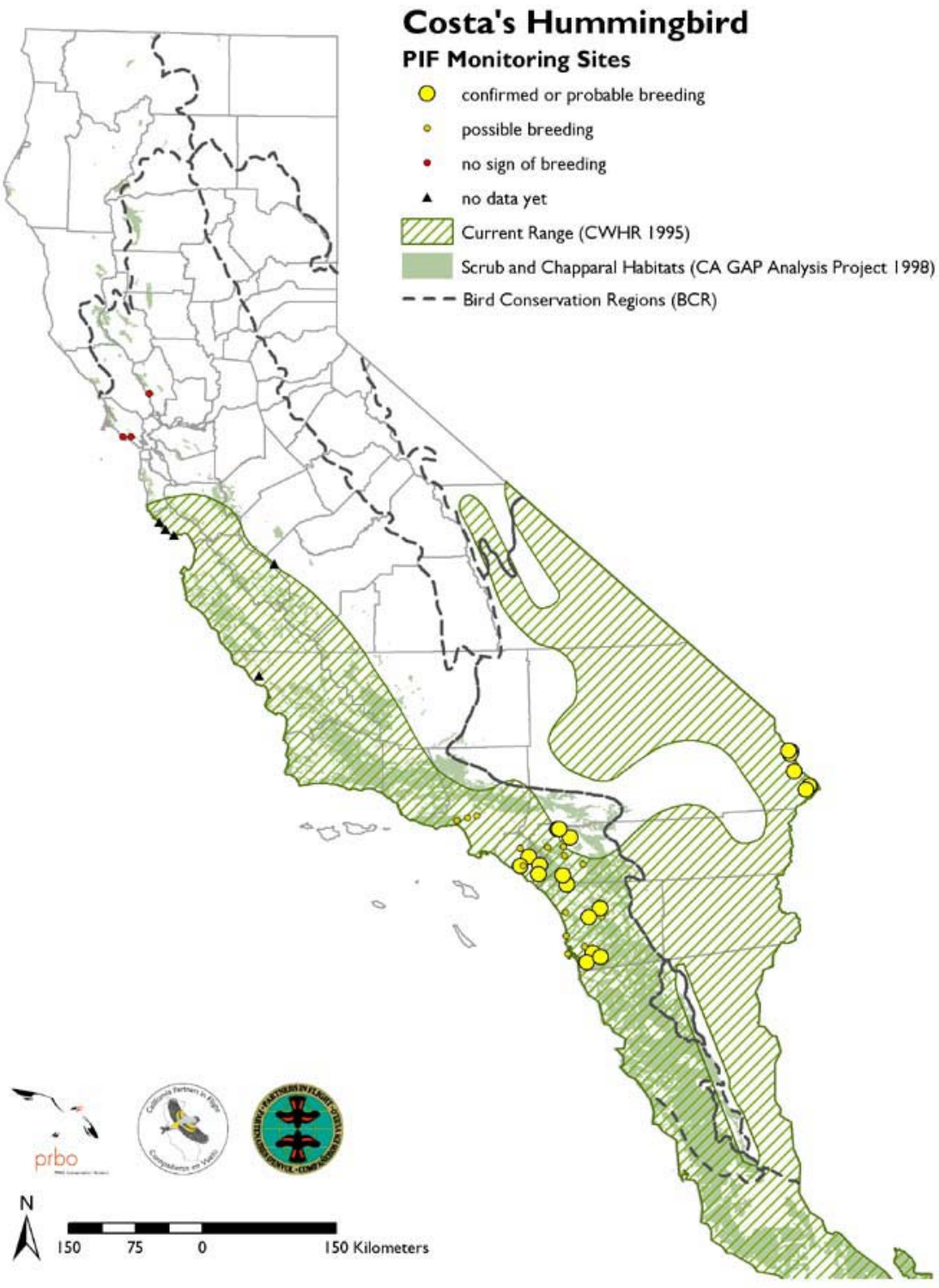


Figure 3-4. PIF monitoring sites, breeding status at these sites, and current range of the Costa's Hummingbird.

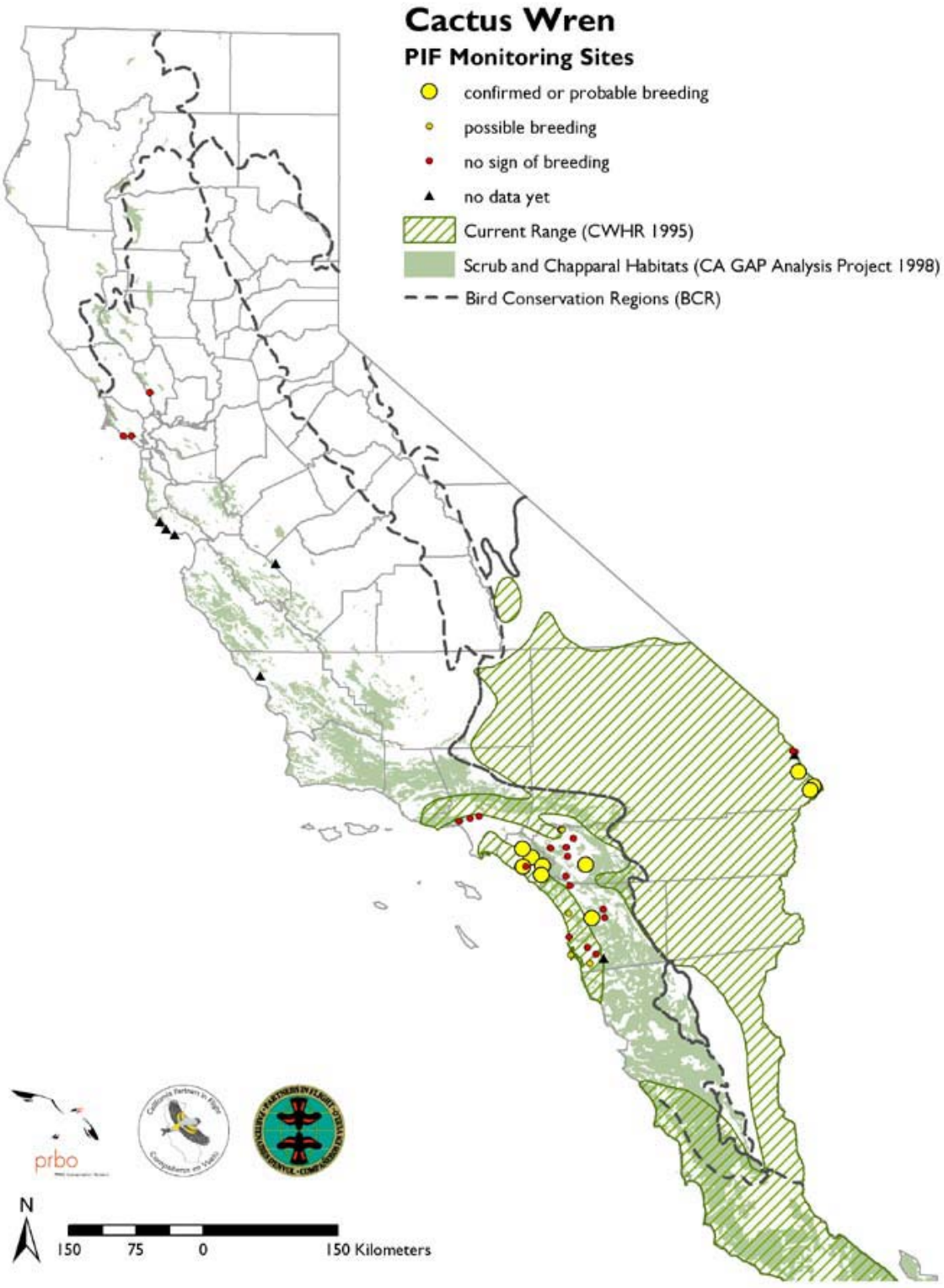


Figure 3-5. PIF monitoring sites, breeding status at these sites, and current range for the Cactus Wren.

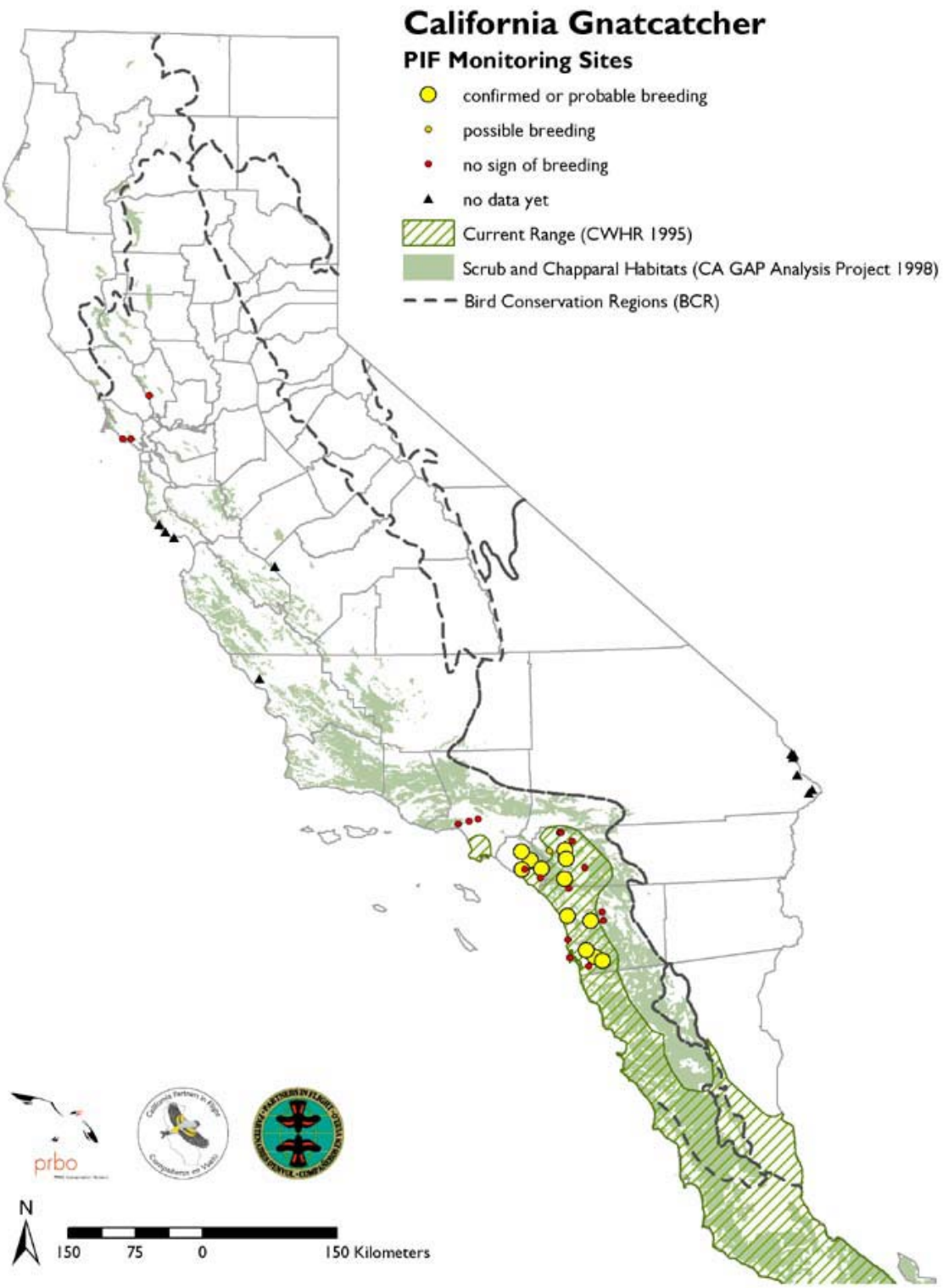


Figure 3-6. PIF monitoring sites, breeding status at these sites, and current range for the California Gnatcatcher.

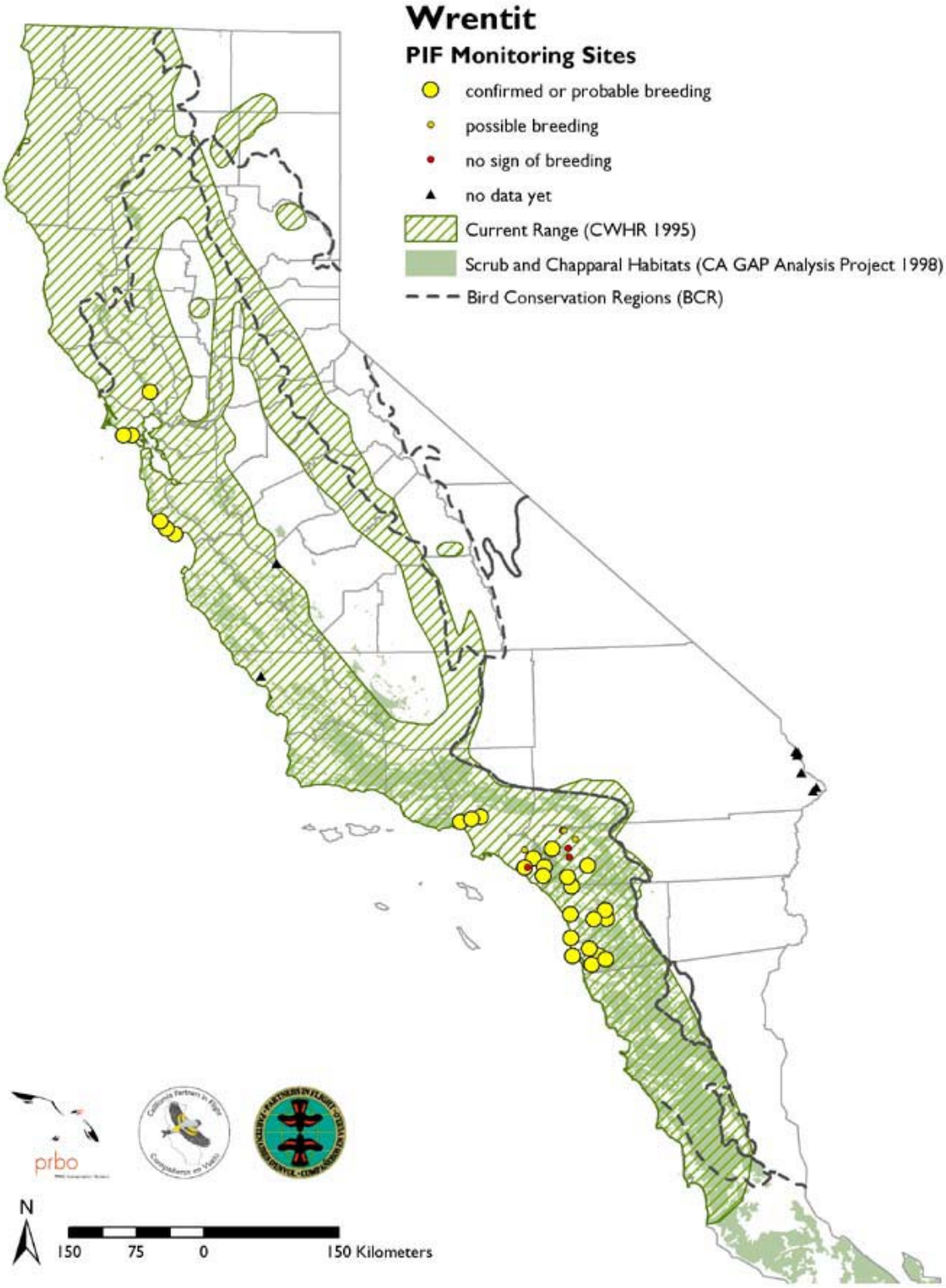


Figure 3-7. PIF monitoring sites, breeding status at these sites, and current range for the Wrentit.

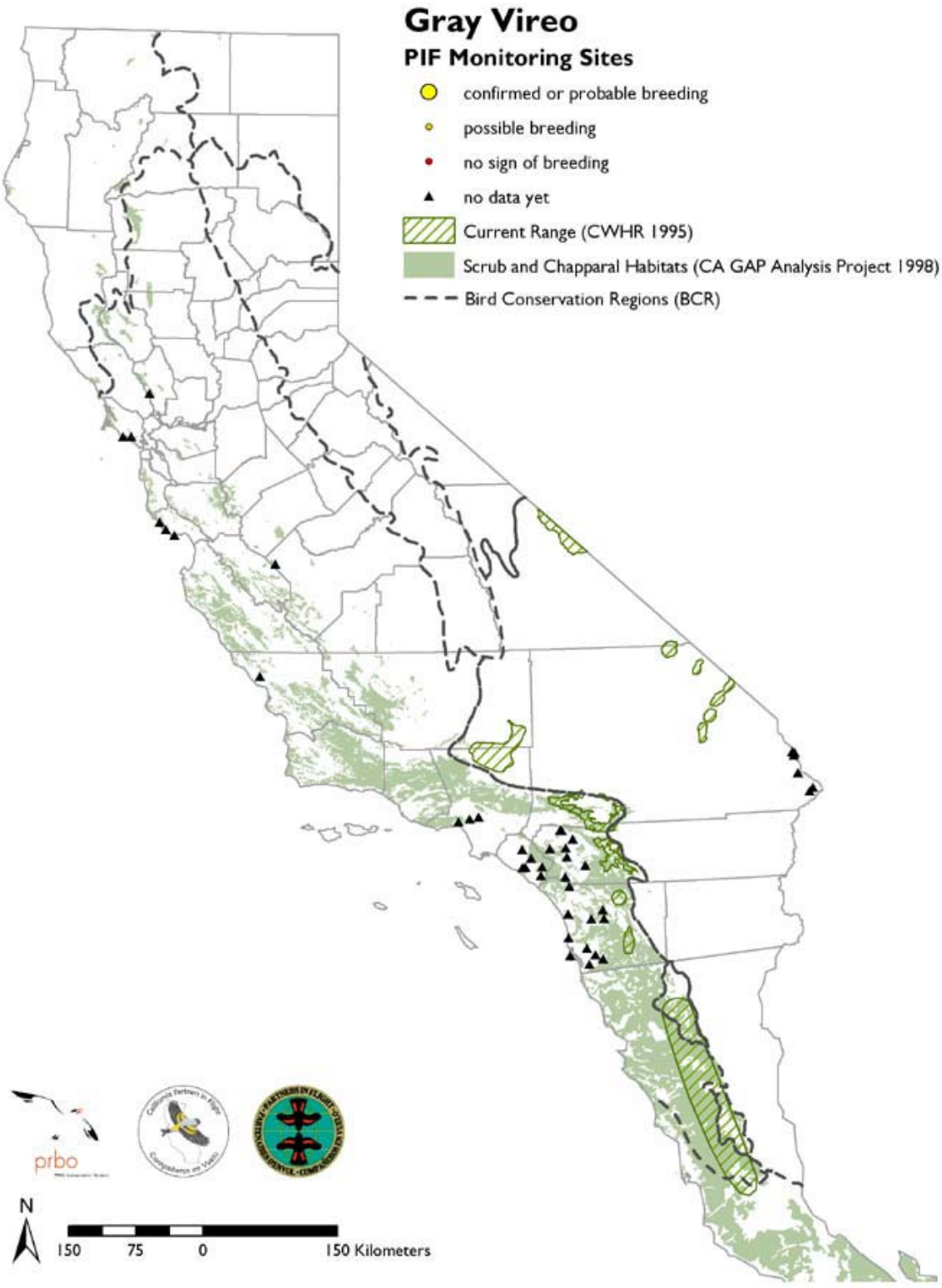


Figure 3-8. PIF monitoring sites, breeding status at these sites, and current range for the Gray Vireo.

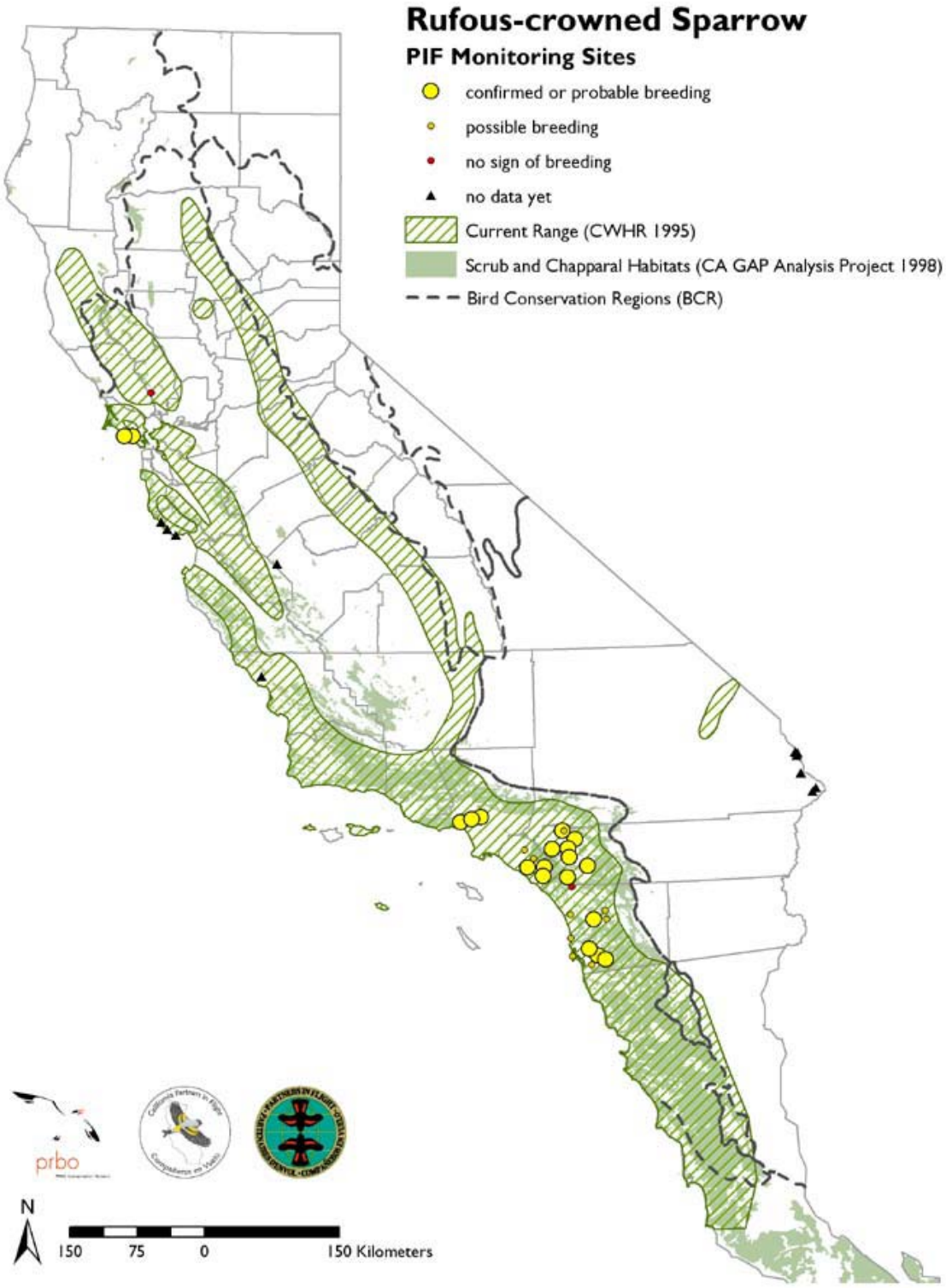


Figure 3-9. PIF monitoring sites, breeding status at these sites, and current range for the Rufous-crowned Sparrow.

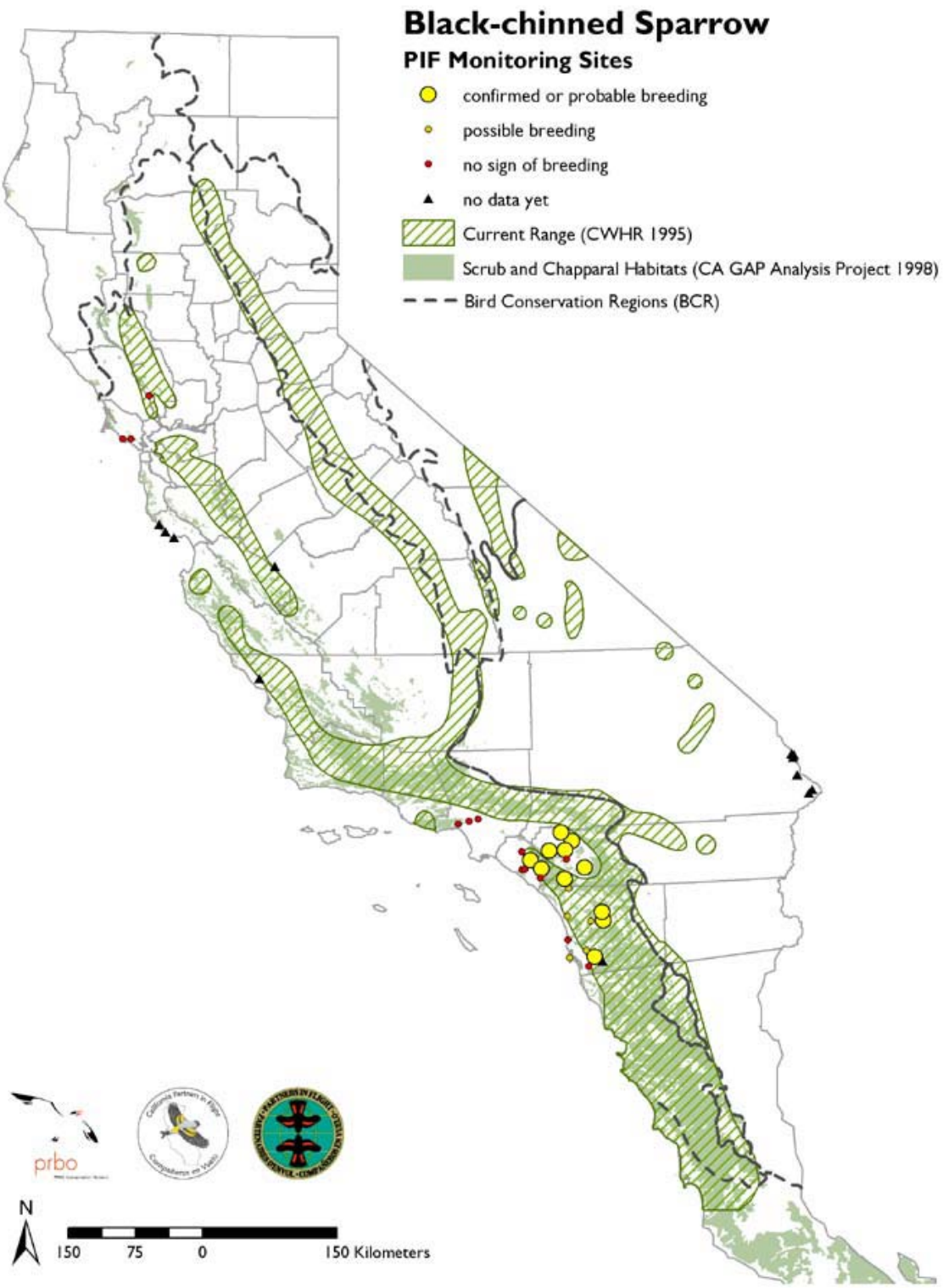


Figure 3-10. PIF monitoring sites, breeding status at these sites, and current range for the Black-chinned Sparrow.

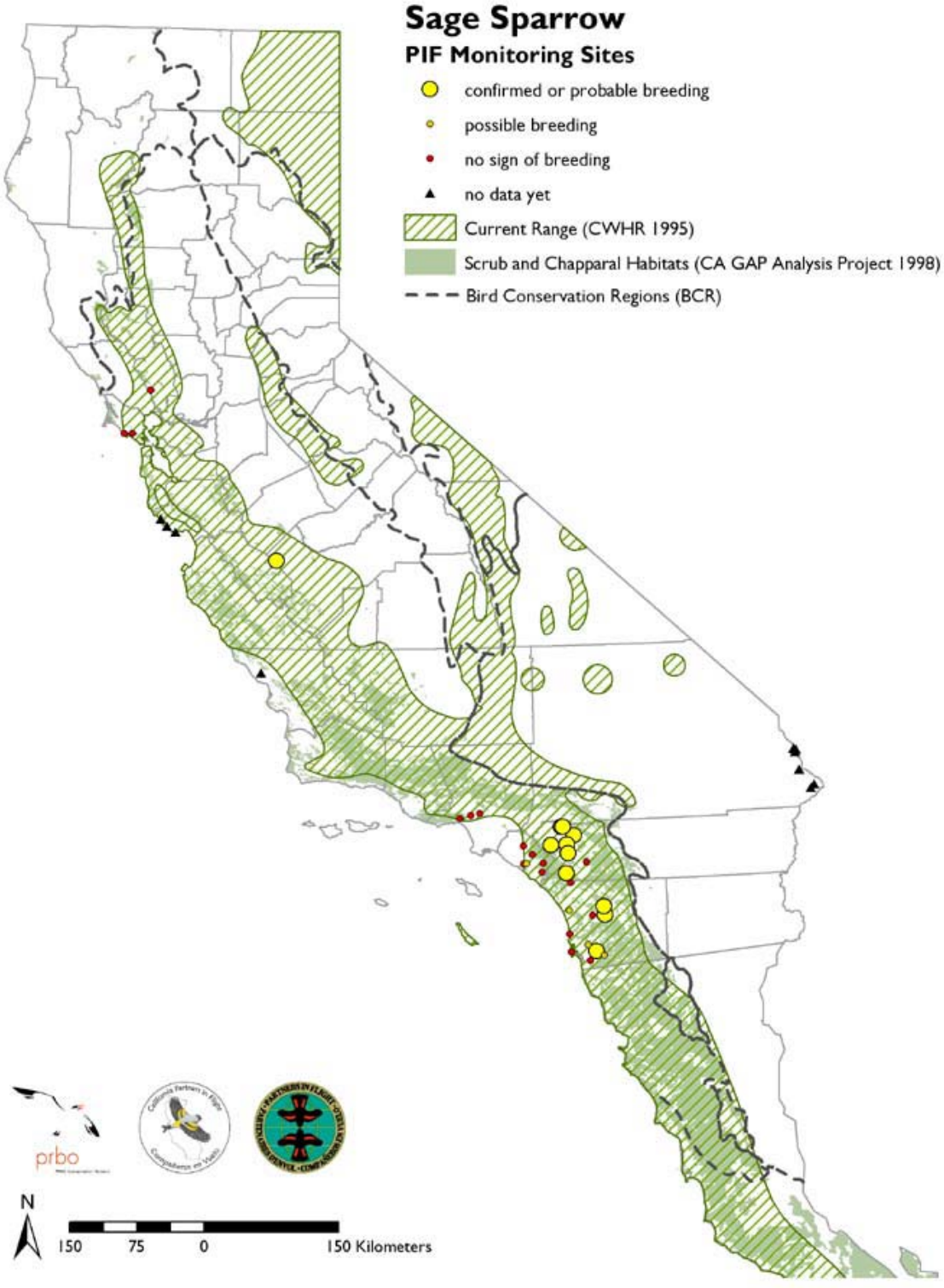


Figure 3-11. PIF monitoring sites, breeding status at these sites, and current range for the Sage Sparrow.

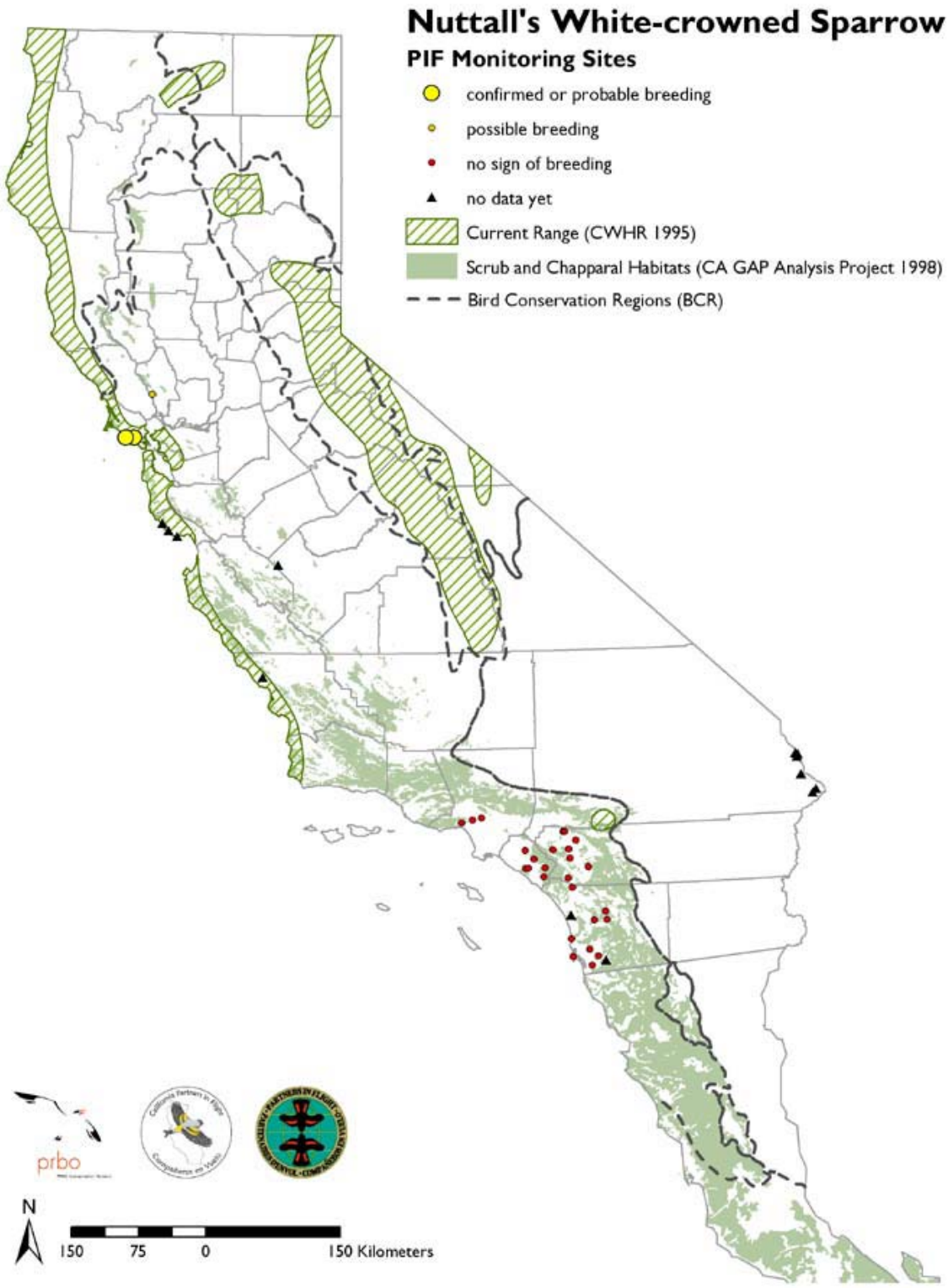


Figure 3-12. PIF monitoring sites, breeding status at these sites, and current range for the Nuttall's White-crowned Sparrow.

Chapter 4. Problems Affecting Coastal Scrub and Chaparral Birds

This chapter reviews the major threats to chaparral and coastal scrub habitats and the birds they support. While habitat loss is the overriding problem affecting shrubland birds in coastal California, the quality of remaining habitat is also being degraded by processes such as fire, grazing, air pollution, and the invasion of exotic plants.

Habitat Loss

The most profound factor that threatens shrubland birds is the direct and permanent loss of habitat. Permanent habitat loss is most often the result of human land uses, such as residential development, agriculture, or associated factors such as high fire frequencies. In addition to directly reducing the amount of habitat available for birds, habitat loss also changes the size, shape, and connectedness of the remaining habitat. The spatial pattern of habitat loss is very important in determining how habitat loss will affect birds, as discussed below. Thus, the loss of habitat area may cause not only a proportional reduction in the size of bird populations, but also may have more insidious effects on remaining populations, such as reduced reproductive success.

Photo by James Gallagher, Sea and Sage Audubon

California Gnatcatchers have declined substantially due to extensive destruction of their coastal sage scrub habitat.

Habitat loss from urban and suburban development has been particularly severe for coastal scrub habitat, due to its proximity to California's coastal population centers. It has been estimated that up to 90 % of the historic acreage of coastal scrub has been lost to development (Westman 1981, Atwood 1993). Of the remaining coastal scrub habitat, the majority occurs on private lands, and less than 10% is formally protected (Davis et al. 1995).

Remaining chaparral habitats are generally more extensive and better represented in protected areas. However, a few distinct chaparral plant communities are less well protected (Davis et al 1995). Also, as the amount of land available for development at low elevations declines, we may expect to see an increased rate of habitat loss in chaparral areas in the future.

Habitat Fragmentation

Theoretically, a given amount of habitat loss within a landscape can occur in any number of configurations. However, in most topographically varied areas the patterns of human land use are fairly predictable and often result in the creation of many isolated fragments of natural vegetation (Swenson and Franklin 2000). Another consequence of human settlement patterns is that some vegetation types are lost at higher rates than others. In this sense, some shrublands are relatively protected from loss by virtue of their occurrence on steep slopes. Nevertheless, remaining fragments of shrub vegetation may be quite small and isolated from other native landscape elements, such as watercourses. Even where remaining shrublands are still relatively large and connected, the presence of urbanization in the landscape appears to affect the abundance of shrubland birds in remaining habitat (Stralberg 2000).

Fragmented shrubland areas may not provide enough continuous acreage to support those birds that require large areas of habitat for an individual to survive (Soulé et al. 1992, Lovio 1996). However, even birds that can survive in smaller patches of habitat may disappear from fragmented areas. This is because individual birds may have difficulty moving from one habitat fragment to another when the fragments are separated by inhospitable developed areas. Movement through fragmented habitats becomes more risky for the individual birds that move (usually juveniles) and thus the number dispersing successfully from one population to another is reduced. This movement of individuals (dispersal) is necessary to prevent the extinction of bird species because the survival of a bird population in one habitat patch may depend on the influx of new individuals from other habitat patches. Also, if local extinction occurs (i.e., a distinct population dies out), the colonization of that habitat by other individuals of that species may be delayed or prevented. Such systems of isolated habitat remnants connected by occasional dispersal events are referred to as "metapopulations." A reduction in dispersal also can cause a reduction in genetic exchange between populations.

A landscape containing many isolated habitat fragments can be compared to an ocean with many islands. One idea that comes from studying islands (the equilibrium theory of island biogeography; MacArthur and Wilson 1967) states that colonization and extinction rates on habitat islands are influenced by the size of islands and degree of isolation from other islands or "mainlands." This means that more species are typically present on larger and less isolated islands, and the same pattern often holds true for habitat fragments. As the size of fragments decreases and isolation increases, "faunal relaxation" (loss of species) in the region initially results, although the rate of decline depends on many factors. These long term patterns of extinction and recolonization of habitat fragments are also called "metapopulation dynamics." The existence of metapopulation dynamics in particular areas such as coastal southern California is somewhat controversial. Soulé et al. (1992) provide evidence that habitat remnants are rarely if ever "rescued" by dispersal, whereas other studies (ERC 1991, Lovio unpublished data) have documented fairly frequent movement of birds among remnants. However, even fragmentation of shrubland habitats into relatively large remnants will result in the decline or loss of shrubland specialists (Lovio 1996). More recently, Crooks et al. (2001) found that extinctions were more common than colonizations in shrubland fragments.

Fragmentation frequently creates patches of shrubland that have long boundaries with developed areas, and this can create conditions that further compromise the ecological integrity of the habitat. Although natural ecotones (edges) between native habitat types usually provide conditions that enhance diversity (Brown and Gibson 1983), anthropogenic edges often are accompanied by reductions or losses of specialist species (e.g., Bolger et al. 1997). In California wildland-urban interfaces, improving vegetation structure and increasing the availability of water and food may improve habitat value near edges for some species. Complex interfaces often mimic natural ecotones in that they support enhanced diversities of birds (Guthrie 1974, Lovio unpublished observations). However, negative edge effects include the creation of barriers to dispersal, increases in native and non-native predators (Crooks and Soulé 1999), and potential increases in nest parasitism by the Brown-headed Cowbird. A complex causal relationship between the decline of large predators (e.g., coyotes and bobcats) associated with human development, the resultant increase in mid-sized native and non-native predators, and the predator-mediated declines of nesting birds has been postulated (Soulé et al. 1988, Crooks and Soulé 1999), but needs more study.

Photo by Eric Preston, ericpreston.com

Avian nest predators such as jays, magpies, crows and ravens tend to benefit from human habitation.

Repeated historical sequences of land use can result in "counter-current" processes of natural vegetation loss and recovery. For example, in rural areas where land has been used for agriculture, a change in land use to residential development may result in a further reduction of undeveloped land. However, such changes may also allow native vegetation to grow back in remnant parcels (e.g., conservation easements or greenbelts), thus reversing previous patterns of native versus non-native conditions. The benefits of such historical change are complicated, however, by the detrimental aspects of anthropogenic edge, which also afflicts undisturbed habitat areas.

Habitat Degradation

Another major factor affecting birds is habitat degradation. Habitat degradation includes any changes in habitat structure (e.g., height, percent of ground covered) or species composition (e.g., presence of non-native species) caused by direct and indirect, human-related activities. The scale of alteration is very important in determining the outcome on bird assemblages. Generally, localized disturbances of about the same size as avian territories that occur within large, unbroken habitat areas may have no effect on the breeding densities of most species and may actually enhance local diversity (Wiens et al. 1986, Lent and Capen 1995, Lovio unpublished data). The effects, however, vary among even those species considered sensitive or specialists.

In southern coastal scrub, a 60% loss of vegetation volume from one discrete disturbance event on a 43.6 hectare study plot resulted in an increase in breeding density of Rufous-crowned Sparrows, no change in Sage Sparrows, and a questionable decline in density of California Thrashers in subsequent years (Lovio, unpublished data). Results of these studies suggest a certain level of compressibility of home ranges, but with uncertain effects on reproductive success. Wiens et al. (1986) also suggest that philopatry (the tendency of birds to remain in or return to established breeding grounds) may explain some degree of persistence of original breeding densities within altered habitat over short periods of time.

Despite this suggestion, intentional depletion or alteration of habitat patches within large areas in connection with wildland management must be exercised with great caution and is generally not recommended. Many preserve areas near urban or agricultural areas already represent mosaics of disturbance history that provide a full range of habitat diversity. Furthermore, numerous local disturbances within a given area may collectively constitute a high proportion of habitat loss. Habitat loss and degradation often exist at a frequency that exceeds the capabilities of damaged areas to recover before the next disturbance.

Some large-scale degradation and loss of chaparral habitat has taken place through mechanical or chemical conversion to grassland (Lillywhite 1977). Currently, fire, air pollution, and the invasion of exotic plant species are three major, interacting processes responsible for much of the large-scale degradation of shrubland habitats (Allen et al. 2000).

Shrubland Birds and Fire

Fire primarily affects shrubland birds through its effects on plant communities. Chaparral and coastal scrub plant communities have evolved in a fire-prone environment, and thus most species are well-adapted to fire. Chaparral is especially fire-adapted, with many shrub species re-sprouting vigorously from their root crowns after fire, and the seeds of many herbaceous plants germinating only after fire (Hanes 1971, Mooney and Conrad 1977). When shrub habitats are allowed to recover naturally from fire, birds and other wildlife usually quickly recolonize burned areas, and even occasionally increase in density in comparison to unburned sites (Lillywhite 1977, Wirtz 1977, 1979, 1982, Moriarty et al. 1985). The time it takes for a given shrub-requiring bird species to return to burned shrublands, and the speed at which its numbers increase, are probably related to whether it is typically associated with more open coastal shrubland habitats or more dense habitats (Moriarty et al. 1985). The ability of birds to recolonize burned areas also likely depends on the existence and proximity of unburned habitat, which can act as both a refuge for birds leaving the burned area and a future source of immigrants into recovering habitats (Bontrager et al. 1995, Mayer and Wirtz 1995). Bird use of burned shrublands also depends on the speed at which shrubby vegetation regenerates and on the amount of unburned vegetation remaining within the burned area.

The frequency of fire that best promotes the persistence of shrubland plant and animal communities varies depending on the type of shrub habitat and its geographic location. Loss of shrubland habitat can result either when fire is too frequent or when it is absent for too long (Keeley 1995a). For example, in the northern part

of the range of chaparral and coastal scrub, plant succession can result in the relatively rapid conversion of shrubland to woodland in the absence of fire (McBride 1974, Menke and Villaseñor 1977). This successional process can lead to local declines in the abundance of birds associated with shrub habitats (PRBO, unpublished data). In contrast, chaparral in Southern California may persist for a century without fire (Keeley 1992). Although some shrub habitats may be converted to forest by succession, the far greater threat to California shrublands is due to the occurrence of very frequent fires.

Fire frequency in California shrublands has been increasing in recent decades and is positively correlated with human population density (Keeley et al. 1999). Humans start the majority of fires in California shrublands, and the spread of human development and habitat fragmentation increases the risk of frequent fires. Fire frequency is also promoted by the spread of non-native plant species, as discussed below. Multiple studies suggest that fire at intervals of < 5-10 years may cause the conversion of chaparral and coastal scrub to non-native annual grasslands (Malanson 1985, Keeley 1995a, Minnich and Dezzani 1998). Coastal scrub habitats are less resilient after fire than chaparral (O'Leary 1990), and the persistence of some coastal scrub plant species may even be threatened by fires that occur every 30-40 years (Malanson 1985). The process of conversion from shrubland to annual grassland is taking place on a large scale, especially in southern coastal scrub (Minnich and Dezzani 1998). When shrubland habitats are converted to annual grassland, they no longer support many species of shrub-requiring birds and other native animals (Lillywhite 1977, Soulé et al. 1988, 1992).

Invasion of Non-Native Species

Degradation of southern coastal scrub and chaparral through gradual invasion by non-native vegetation has also been documented (Alberts et al., unpublished data, ref. in Soulé et al. 1992, Keeley 1995a, Minnich and Dezzani 1998). The precursors to such invasion include mechanical, chemical or fire-related habitat disturbance, proximity of sources of exotic plants, and altered water regimes. These changes render many remnants unsuitable for certain specialized bird species. Established exotic grasses can cause reduced germination, seedling growth, and survival of young California sagebrush and thus inhibit post-disturbance establishment of sagebrush from seed (Eliason and Allen 1997).

Fire and non-native plant invasions interact in complex ways. The deliberate re-seeding of shrubland areas that have burned with non-native species obviously contributes to the establishment of exotics, but also creates ideal conditions for recurrent fires. Non-native grasses dry out sooner in the spring and provide a continuous fuel bed that promotes the spread of additional fires. These recurrent fires in turn promote the further spread of non-native species (Keeley 1995a, Minnich and Dezzani 1998). Although resource managers are now reducing their use of non-natives for reseeding, non-natives are so well established that they are likely to continue to spread on their own. Non-natives may also be spreading due to their ability to out-compete native plant species and due to increases in soil nitrogen caused by air pollution (reviewed in Minnich and Dezzani 1998, but see also Padgett and Allen 1999). Air pollution also has direct negative effects on coastal sage scrub plant species (O'Leary 1990, Allen et al. 2000). When shrubland is replaced by grassland, birds that prefer shrub habitats will be replaced by grassland birds (Lawrence 1966).

Grazing

Livestock grazing has contributed to the degradation of coastal sage scrub by preventing the growth of young shrubs, opening up the scrub canopy to invasion by exotic annuals, and reducing the ability of native forbs and grasses to compete with exotics (McBride and Heady 1968, McBride 1974, O'Leary 1990). Currently, the impacts of grazing are most extensive in the inland portions of the range of southern coastal scrub vegetation (O'Leary 1990, Minnich and Dezzani 1998).

Chapter 5. Species-Specific Recommendations and Population Targets

Species-Specific Recommendations

The birds of California's coastal scrub and chaparral habitats 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.

Although California Partners in Flight 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 coastal scrub or chaparral habitats, 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. Furthermore, conservation planners must bear in mind that population dynamics are influenced by many factors other than breeding habitats (e.g., overwintering survival, juvenile recruitment into the breeding population) and may result in population declines even as efforts increase available quality habitat.

In preparation for this conservation plan, California Partners in Flight developed a series of species accounts on a suite of scrub-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. Information in the species-specific recommendations is derived from these accounts unless otherwise cited. The accounts will be available as electronic appendices to this plan at http://www.prbo.org/calpif/htmldocs/scrub.html. Below are recommendations for seven of the focal species.

These recommendations need to be implemented, monitored, and altered as necessary. As this plan is a "living document," so should these recommendations. With future research, management decisions can be made that best benefit both the birds and humans using these coastal scrub and chaparral habitats.

Greater Roadrunner (*Geococcyx californianus*)

Population:
Greater Roadrunners are year-round residents occurring at low densities in relatively open chaparral and coastal scrub habitats of California (Figure 3-2). Historically, they ranged throughout southern California and north through the foothills of the Central Valley and Owens Valley. Recently, however, Greater Roadrunners have been reported as extirpated from significant portions of this range, including the northern Central Valley,

Adrienne Olmstead

the San Francisco Bay Area, and parts of Santa Barbara and San Diego Counties (refs. in Hughes 1996). Populations may also be shrinking in the rest of coastal southern California and in some desert areas (Small 1994). Breeding bird survey results suggest a decline in California, but data are insufficient to draw strong conclusions due to insufficient detection rates. Although tolerant of some degree of human disturbance, they may be unable to survive where agricultural or urban development is extensive (Hughes 1996, Small 1994).

Habitat needs:
Within California shrublands, Greater Roadrunners prefer habitats with a mix of shrub cover for nesting and open areas of low grasses for foraging. They occasionally occur in open farmland and in less densely developed suburban areas. However, Greater Roadrunners were often missing from habitat fragments in an urban landscape (Soulé et al. 1988), perhaps because they require large territories (0.7-0.8 km in diameter, Hughes 1996). Management should focus on preserving large areas that contain a mixture of shrub and open habitat with minimal human development.

Value as indicators:
The presence of Greater Roadrunners in a habitat fragment is an indicator of the presence of other shrubland bird species (Soulé et al. 1992). Within coastal sage scrub, Greater Roadrunners are strongly associated with the presence of other species characteristic of dryer, inland coastal scrub habitats, including both birds and small mammals (Chase et al. 2000).

Pesticide use:
As omnivores and opportunistic predators, Greater Roadrunners are exposed to pesticides via their consumption of prey such as insects, reptiles, birds, and rodents. Pesticide contamination may be widespread, since residues have been found in some prey items and in the bodies of two Roadrunners tested in California (Kieth and Hunt 1966). However, the long-term effect of pesticides on Greater Roadrunner populations is unknown.

Public education:
Greater Roadrunners have a history of persecution by humans who believed them to be predators of quail. Although research has shown that this species rarely eats quail, some continue to be shot illegally. Public education about the value of Greater Roadrunners as consumers of agricultural and household pests may be beneficial to their populations.

Research and Monitoring:
Many aspects of the Greater Roadrunner's life history are poorly understood. The low density and elusive behavior of this species makes its study difficult. Research on the impact of human disturbances (e.g., urban development, pesticide use, and illegal hunting) is needed for conservation and management decisions regarding this species. Because Breeding Bird Survey data on Greater Roadrunners is sparse for shrubland habitats in California, targeted monitoring efforts may be needed for a better understanding of population trends, and to confirm local extirpations.

Photo by Peter Knapp

Cactus Wren (*Campylorhynchus brunneicapillus*)

Population:
As their name suggests, Cactus Wrens are found primarily in desert habitats dominated by cactus and desert scrub. However, a geographically isolated coastal population also exists that is dependent on coastal sage scrub habitat (Figure 3-5). The coastal Cactus Wren *(C. b. sandiegensis)* that occurs from Orange County south has been designated a species of special concern by the Department of Fish and Game. This Cactus Wren population was estimated to contain fewer than 1500 pairs in the early 1990's, and is believed to be declining due to loss of habitat. The Cactus Wren has been chosen as a "target" species in the state of California's Natural Community Conservation Planning (NCCP) program.

Zac Denning

Habitat needs:
Within coastal sage scrub, Cactus Wrens occur almost exclusively in thickets of cholla and prickly pear cactus below 450 meters (1476') in elevation. The protection of suitable coastal habitat for Cactus Wrens is a high priority, due to their high degree of habitat specialization, sedentary behavior, and possibly low dispersal capability.

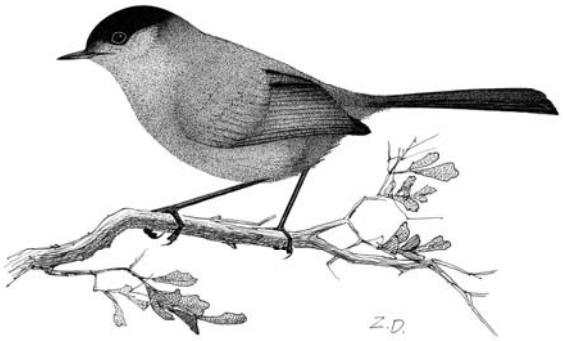
Fire management:
Wildfires may be more detrimental to Cactus Wrens than other coastal sage scrub residents due to the slow post-fire recovery rate of the required large cactus stands. Habitat fragmentation and other human disturbances that increase fire frequency should be minimized.

Research and Monitoring:
Continued monitoring of Cactus Wren populations is clearly necessary. Research topics with high priority include determining the factors affecting population dynamics and identifying threatened breeding populations and habitat areas that are most susceptible to large-scale habitat loss.


Photo by James Gallagher, Sea and Sage Audubon

California Gnatcatcher (*Polioptila californica*)

Population:



Zac Denning

This small, resident songbird is one of the most threatened inhabitants of California's shrublands. The California Gnatcatcher was considered locally common in the mid-1940's, but since then its population has declined substantially in California due to extensive destruction of its coastal sage scrub habitat. Within California, California Gnatcatchers currently occur locally from the Palos Verdes Peninsula in Los Angeles County through Orange, Riverside, San Bernardino, and San Diego Counties (Figure 3-6). In the 1990's, the total U. S. population of gnatcatchers was variously estimated to be between 1,645 and 2,899 pairs, with the majority occurring in San Diego County. The California Gnatcatcher was listed as a federally "threatened" species in 1993. California Gnatcatchers have provided the major impetus for the development of the state of California's Natural Community Conservation Planning (NCCP) program for the coastal sage scrub ecosystem.

Habitat preservation:

Protection of sufficient high-quality coastal sage scrub habitat is the primary requirement for the conservation of California Gnatcatchers. California Gnatcatchers typically prefer low-elevation scrub with a relatively open or broken canopy, containing significant amounts of California sagebrush and California buckwheat. They occur less often in low scrub with a closed canopy, and rarely in scrub dominated by tall shrubs. Special emphasis should be placed on identifying and protecting habitats that are associated with high reproductive success and favorable values of other demographic parameters. For example, in Riverside County, preserve planning should take into account the habitat features that Braden et al. (1997) found to be associated with increased reproductive success. Ideally, protection should be extended to include unoccupied coastal sage scrub habitat that appears suitable, as well as chaparral, grassland and riparian habitats that are adjacent to coastal sage scrub.

Landscape fragmentation and connectivity:

Although California Gnatcatchers do not appear to avoid habitat edges and may be able to breed successfully near urban edges, they may avoid settling in smaller fragments in urban environments. Thus, fragmentation of existing habitat should be minimized. Because most of the remaining coastal sage scrub habitat is already fragmented to some degree, reserves should be designed to maximize connections between coastal sage scrub patches. Connectivity allows for dispersal among populations, which is essential for the persistence of fragmented gnatcatcher populations. Even narrow corridors of shrubland habitat or "stepping stone" patches of habitat may contribute to connectivity by allowing dispersal of juvenile birds.

Fire management:

California Gnatcatchers may not re-occupy burned areas for at least 5-7 years and populations in "old-growth" coastal scrub may be more persistent over the long-term. Therefore, high fire frequencies should be avoided in habitat reserves. California Gnatcatchers are known to relocate from burned areas to unburned refugia, and thus large-scale fires may damage gnatcatcher populations in both burned and unburned areas. Habitat fragmentation and other human disturbances that increase fire frequency should be minimized, and reserve design should take into account the need for fire refugia.

Revegetation:
Although published studies are few, they suggest that California Gnatcatchers will re-colonize and breed in revegetated coastal sage scrub. Therefore, revegetation deserves further investigation as an important component of long-term management for this species.

Exotic vegetation:
Frequent fires, grazing and air pollution all are contributing to the competitive exclusion of native shrubs by exotic annual grasses and forbs, especially in Riverside County. As mentioned above, habitat fragmentation and fire frequency should be minimized. Wherever possible, invading exotic species should be removed before they take over, for example, at the edges of habitat reserves.

Nest parasitism and predation:
Nest depredation and brood parasitism may have serious consequences for the long-term viability of gnatcatcher populations. Severe brood parasitism occurs only in restricted portions of the California Gnatcatcher's range, and populations within those limited areas may benefit from Brown-headed Cowbird control. More generally, habitat preservation and management should be focused on those habitat characteristics found to be associated with reproductive success.

Research and monitoring:
Monitoring of California Gnatcatcher populations is an essential part of evaluating the effectiveness of the massive conservation planning efforts made on its behalf. Monitoring protocols should be based on the best available scientific knowledge to ensure accurate measurements of population trends. Off-road monitoring is crucial. Nest success and the factors that influence it should be monitored directly (through nest monitoring) in replicate sites to evaluate management options.

Although California Gnatcatchers are perhaps the most intensively studied bird species in California shrubland habitats, Atwood (cited in Rotenberry and Scott, 1998) identified four primary areas where further research is needed for effective conservation planning:

1) How long does it take habitat disturbed by fire or created by restoration to be able to support successfully breeding gnatcatchers?
2) How do dispersal patterns affect the genetic and demographic connectivity of subpopulations?
3) What drives long-term, large-scale patterns of variation in demography?
4) How can we identify, and perhaps rank, good quality habitat over large spatial scales?

In addition, further studies of California Gnatcatcher dispersal capability are needed to help design adequate habitat linkages between core populations.

Wrentit (*Chamaea fasciata*)

Tad Theimer

Population:
Wrentits are abundant year-round residents of cismontane shrub lands, particularly coastal scrub and chaparral. Within California, Wrentit populations are generally stable, and appear to be expanding eastward in the Sierra Nevada. Breeding Bird Survey trends are non-significant and show slight declines in some areas and slight increases in other areas. Although widespread and common in California shrublands, Wrentits have a relatively small geographic range, the majority of which is in California (Figure 3-7).

Habitat needs:
Wrentits prefer northern coastal scrub, relatively dense coastal sage scrub, and lowland hard and montane chaparral, but they also may be found in other habitats that include a somewhat dense shrub understory (e.g., riparian). Due to their high breeding density, Wrentits may persist longer in habitat fragments than other shrubland species. However, their limited dispersal abilities may make fragmented populations vulnerable to extirpation in the long-term. The proximity of urbanized areas and reduction in patch sizes have been linked to local declines in abundance or extirpation. Thus, habitat protection efforts should target mature, dense shrub habitats, work to minimize fragmentation, and incorporate corridors connecting habitat fragments.

Research and Monitoring:
Further research on Wrentits in fragmented habitat is recommended to understand how populations are affected in the long-term by fragmentation, and to test the utility of corridors connecting Wrentit breeding sites. Because the majority of the world's Wrentits occur in California, population trends should be monitored carefully.

Photo by James Gallagher, Sea and Sage Audubon

Gray Vireo (*Vireo vicinior*)


Adrienne Olmstead

Population:
Gray Vireos breed in chaparral and pinyon-juniper woodland habitats across a discontinuous range within the mountains of southern California. Reported population densities in occupied habitat range from 1.6 birds per 40 hectares in the Santa Rosa Mountains (Weathers 1983) to 4.5 birds per 40 hectares (USDA Forest Service 2002). Although historical range data are incomplete, they apparently no longer occur in some northern portions of their historic range, specifically Kern County and the San Gabriel Mountains (Figure 3-8). Parasitism by Brown-headed Cowbirds has been suggested as a possible reason for the range contraction. However, data are lacking on parasitism rates and nest outcomes in California. No quantitative data are available on population trends in California. The Gray Vireo has been listed as a Species of Special Concern by the state of California.

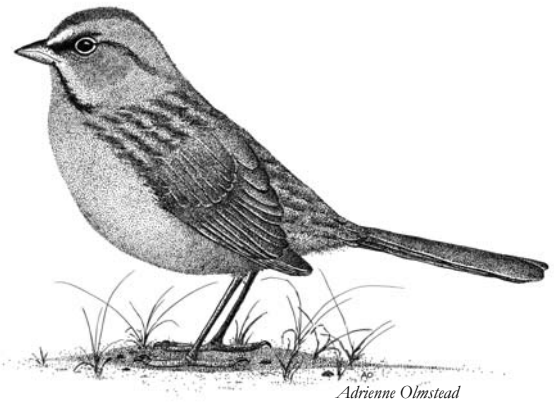
Habitat needs:
Within the Peninsular Ranges of Southern California, Gray Vireos depend on dense, mature chaparral habitat dominated by chamise or redshank. Gray Vireo populations may be negatively impacted by fragmentation and edge effects, and by cowbird parasitism. Thus, management should emphasize the preservation of large, unfragmented stands of chaparral. Fire frequency should be managed so as to reduce the chances of converting chaparral habitat to grassland. In the dryer, inland portions of their range, pinyon-juniper woodland appears critical as breeding habitat, and elephant trees may be important as wintering habitat. Grazing should be managed so as not to result in loss or degradation of chaparral or pinyon-juniper habitat.

Research and monitoring:
Much remains to be learned about the range and status of Gray Vireo populations in California. New information on the range of Gray Vireos has emerged from breeding bird atlas efforts in San Diego County. Therefore, ongoing atlas efforts in San Diego, Riverside, and San Bernardino should be encouraged and supported to complete our knowledge of Gray Vireo distribution and breeding habitat requirements. Surveys of sites where Gray Vireos were historically present also are recommended. The USFS has developed a "double-sampling" protocol for Gray Vireo surveys, combining rapid extensive surveys with focal intensive surveys (USDA Forest Service 2002). The wintering range of the California breeding population is also an important gap in our knowledge about this migratory species. Because of their patchy occurrence within their range, targeted monitoring efforts may be needed for a better understanding of population trends.

The impacts of brood parasitism and nest depredation on Gray Vireo reproductive success need to be examined. It is imperative that we understand whether Gray Vireos are especially vulnerable to brood parasitism, lest they go the way of their endangered congener, the Least Bell's Vireo (*Vireo bellii pusillus*). Also, research into the effects of fire frequency and grazing on Gray Vireo habitats is crucial to their effective management.

Rufous-crowned Sparrow (*Aimophila ruficeps*)

Population:
Rufous-crowned Sparrows are year-round residents of arid, sunny, often rocky slopes vegetated with grasses and scattered, low shrubs. Two subspecies occur within the area covered by this plan: *A. r. ruficeps*, which is found in central California, and *A. r. canescens*, which is found in southwest California (Figure 3-9). Although Breeding Bird Survey data for these areas are inadequate, Rufous-crowned Sparrow populations are believed to be declining due to loss and degradation of habitat, especially in southern California. The *canecsens* subspecies is listed as a Species of Special Concern by the state of California.


Adrienne Olmstead

Habitat needs:
Habitat conservation for Rufous-crowned Sparrows should focus on drier, more open coastal scrub and low, sparse chaparral, preferably on moderate to steep slopes. Although an intensive study recently found no negative correlation between reproductive success and edge effects, Rufous-crowned Sparrows appear to avoid edges and small habitat fragments (Morrison and Bolger 2002). Thus, although large, unfragmented habitats will probably support larger populations of Rufous-crowned Sparrows, small and fragmented patches may also be of conservation value.

Fire management:
Because they prefer more open shrublands, Rufous-crowned Sparrows may benefit from higher fire frequency than other shrubland birds.

Research and Monitoring:
Studies are needed to determine the optimal timing and intensity of fire required to promote the type of open scrub habitats preferred by Rufous-crowned Sparrows. Further research may also help clarify why Rufous-crowned Sparrows avoid edges, given that it does not appear to be correlated to decreased nest success. Establishing monitoring programs in southern California would help determine whether Rufous-crowned Sparrow populations are indeed declining in that region.

Sage Sparrow (*Amphispiza belli canescens* and *Amphispiza belli belli*)

Population:
Two subspecies of Sage Sparrows occur in the California shrublands covered by this plan. The Bell's Sage Sparrow (*A. b. belli*) is a characteristic chaparral and coastal sage scrub bird found mainly in drier, more inland areas of the Coast Ranges and southern California (Figure 3-11). The *canescens* subspecies is found further inland in even drier, desert scrub habitats. Breeding Bird survey data from throughout the West indicate declining Sage Sparrow populations, but the data from California alone are insufficient to assess local trends. The Bell's Sage Sparrow has been listed as a Species of Special Concern in California.


Zac Denning

Habitat needs:
Sage Sparrows require semi-open habitats with evenly spaced shrubs 1-2 meters high. Habitat preservation for the Bells' Sage Sparrow should focus on inland coastal sage scrub associations and chaparral that contains chamise. Sage Sparrows will benefit from intermediate fire frequencies. Too frequent fires can convert shrubland habitat to grassland and has probably contributed to the decline in Sage Sparrows throughout the western U.S. On the other hand, long-term fire suppression allows taller, thicker chaparral to develop, probably reducing Sage Sparrow habitat in California. Other disturbances that eliminate shrubby vegetation, such as those used in some parts of the west to increase livestock forage, also should be avoided.

Fragmentation sensitivity:
Sage Sparrows in coastal shrublands, as well as in the Great Basin, are highly sensitive to habitat fragmentation, occurring less often near developed edges. Thus, large areas of suitable habitat should be preserved to benefit Sage Sparrow populations.

Research and Monitoring:
As is true of many coastal shrubland bird species, Sage Sparrows are not well monitored by Breeding Bird Survey counts. Given their sensitivity to fragmentation and habitat degradation, monitoring to determine population trends and demographics should be a high priority. Because Sage Sparrows may be attracted to areas where they experience low reproductive success (i.e., "ecological traps"), research into the determinants of reproductive success and habitat quality is especially needed.

Population Targets

California 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 based on assumptions difficult to test, numerical population targets provide a compelling means of communicating with the public and policy makers. Furthermore they provide: 1) monitoring objectives and an evaluation procedure of project success ("accountability"); 2) ranking criteria for project proposals that allow reviewers to determine which sites or projects will be more advantageous for a particular species or suite of species; 3) current data for scientifically sound biological objectives; and 4) integration and comparison with population objectives of larger regional, national, and international schemes (e.g., Rosenberg and Blancher *in press*). 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 coastal scrub/chaparral species have been developed using currently available data (Tables 5-1 and 5-2). 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 for many species in many bioregions. More data likely exist for some of these species, and contributions of data to California Partners in Flight 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 (see Ralph et al. 1993 for explanation of these two nationally standardized monitoring methods). 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 Bioregion[1]. See Table 5-2 for a key to data sources, indicated here by superscripts A-S.

Species	Bay-Delta		South Coast		San Joaquin		Central Coast	
	Point Count	Spot Map	Point Count	Spot Map	Point Count	Spot Map	Point Count	Spot Map
Mountain Quail	-	5.84 [A]	0.025[B]	16.0[C]	0	0	-	-
Greater Roadrunner	-	-	0.20[D]	4.94[E]	-	-	-	-
Lesser Nighthawk	0	0	-	2.76[F]	-	-	-	-
Common Poorwill	-	8.76[A]	-	-	0	0	-	-
Costa's Hummingbird	0	0	0.78[G]	29.63 [H]	0	0	0.18[I]	-
Gray Vireo[2]	0	0	-	2.24[T]	0	0	-	-
Wrentit	1.35[J]	133.6[K]	1.43[L]	44.0[C]	-	-	1.64[I]	-
Coastal Cactus Wren	0	0	0.29[M]	22.07 [F]	0	0	0	0
California Gnatcatcher	0	0	0.50[N]	19.31 [F]	0	0	0	0
LeConte's Thrasher	0	0	0	0	-	-	0	0
Rufous-crowned Sparrow	0.104[J]	-	0.80[O]	29.63[P]	-	-	-	-
Black-chinned Sparrow	-	-	0.48[Q]	24.0[C]	0	0	-	-
Sage Sparrow[3]	-	14.60[A]	1.00[R]	14.81[H]	-	-	0.32[I]	-
White-crowned Sparrow [4]	0.747[S]	32.67 [S]	0	0	0	0	-	-

[1] Numbers provided are derived from available point count and spot-mapping data. Point count data provided is an *index* of abundance, generally thought to be conservative. Average numbers of detections within 50 m of a point (5 min fixed-radius point counts, conducted during breeding season) are presented. Spot map data provided is the number of territories per 40 hectares during breeding season. Dashes represent lack of data for that bioregion; zeroes indicate unlikeliness that the species breeds in the bioregion (from Grinnell and Miller 1944, expert opinion). Bioregions taken from the California Biodiversity Council (RAC 1998). Modoc, Sierra, Mohave, and Colorado Desert bioregions are omitted as outside of the scope of this Plan; Klamath and Sacramento Valley bioregions lacked sufficient data to warrant inclusion.

[2] Density estimated as 2.5 territories per 40 ha based on territory size reported by Grinnell and Swarth (1913) in San Jacinto Mountains; spot map data from the Colorado Desert Bioregion indicates 1.6 territories per 40 ha (Weathers 1983).

[3] *canescens* and *belli* (Bell's Sage Sparrow) subspecies.

[4] Nuttall's White-crowned Sparrow (ssp. *nuttalli*).

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

Alpha code	Data source and location.
A	Gaines (1975), Napa County.
B	USGS unpublished data, 1999-2000,Tenaja Corridor, Santa Ana Mountains, Riverside and San Diego Counties.
C	Kramer (1984), San Diego County.
D	Rotenberry et al. (2001), Motte Rimrock Reserve, Riverside County.
E	Weaver (1984a), San Diego County.
F	James (1993), Orange County.
G	Rotenberry et al. (2001), Limestone Canyon, Orange County.
H	Weaver (1983), San Diego County.
I	PRBO unpublished data, 2001, from Pinnacles National Monument, San Benito and Monterey Counties.
J	Holmes et al. (1998), Marin County.
K	Geupel and Ballard (2002), Marin County.
L	Rotenberry et al. (2001), Pamo Valley, San Diego County.
M	Rotenberry et al. (2001), Sand Canyon Reservoir, Orange County.
N	Rotenberry et al. (2001), Orange Hills, Orange County and Camp Pendleton, San Diego County.
O	Rotenberry et al. (2001), Kabian Park, Riverside County.
P	Weaver (1984b), San Diego County.
Q	Rotenberry et al. (2001), Starr Ranch, Orange County.
R	Rotenberry et al. (2001), Motte Rimrock Reserve, Riverside County.
S	PRBO unpublished data: point count data from Point Reyes National Seashore and Golden Gate National Recreation Area 1998-9; spot map data from Palomarin Field Station (Point Reyes National Seashore) 1977, where NWCS have been steadily declining to only 8.12 territories per 40 ha in 1998.
T	USDA Forest Service (2002), Cleveland National Forest, San Diego County.

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 6-1 for bioregion boundaries. These contrast slightly with the 11 discrete regions recognized by Sawyer and Keeler-Wolf (1995) and Biosystems Analysis (1994).

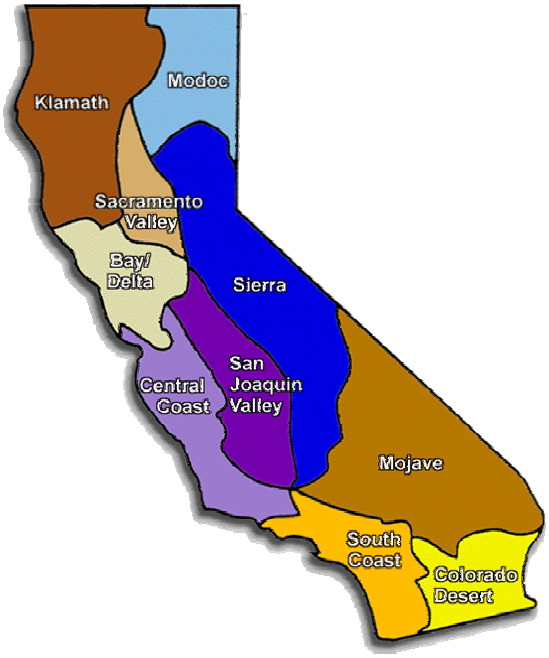


Figure 6-1. Bioregions of California. From the Biodiversity Council (2003).

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

Portfolio Sites

For each bioregion, we list potential "Portfolio Sites," i.e., areas that are distinguished by their protected status and potential for managing shrubland habitat for birds. Many of these Portfolio Sites contain shrubland 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. 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 that are prime candidates for conservation and are prioritized 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 shrubland birds are expanded.

South Coast Bioregion

The South Coast Bioregion extends 200 miles north from the border with Baja California, Mexico, and stretches from the edge of the Mojave Desert in the east to the Pacific Ocean in the west. This region encompasses all or part of six California counties: the southeastern portion of Ventura County (http://www.ceres.ca.gov/geo_area/counties/Ventura/), all of Orange County, most of Los Angeles County (http://www.ceres.ca.gov/geo_area/counties/Los_Angeles/), the southwestern edge of San Bernardino County, the western end of Riverside County, and the western two-thirds of San Diego County. The South Coast is the most populous of all the recognized bioregions, and contains 56% of the State's population. Two of California's largest metropolitan areas, Los Angeles and San Diego, are located here.

The South Coast Bioregion, in general, experiences a mild, Mediterranean climate, with hot, dry summers followed by cool, wet winters. Landscape features of the region include narrow mountain ranges, broad fault blocks, alluvial lowlands, coastal terraces, and a series of offshore islands. Elevations range from sea level to 3,500 meters (11,499') at San Gorgonio Peak in the San Jacinto Mountains of Riverside County. Major rivers and their watersheds include the Santa Clara, Los Angeles, Santa Ana, San Gabriel, San Luis Rey, San Jacinto, Santa Margarita, San Diego, San Diegito, Sweetwater, and Tijuana. U.S. Forest Service ecological units in the bioregion include the Southern California Coast and Southern California Mountains and Valleys sections (USGS 2002). Air quality has been and continues to remain a serious problem, particularly in the Los Angeles basin.

The high degree of inherent natural biodiversity is reflected in the region's unique and diverse vegetation communities. Habitats vary from coastal sage scrub, chaparral, coastal oak woodland, juniper-pinyon woodland, and annual grasslands at lower elevations to mixed hardwood forest, southern oak, southern Jeffrey pine and southern yellow pine in the higher mountain areas. Salt marshes and lagoons were formerly common along the coast. Tremendous urbanization within the South Coast Bioregion has resulted in large-scale alteration and destruction of habitat and a proliferation of exotic or non-native species. Most of the vegetation communities within this region have been reduced to a small fraction of their former cover and now exist in highly fragmented and degraded condition. The largest number of endangered, threatened and Species of Special Concern in the contiguous 48 states are found here.

Although 60 percent of the South Coast Bioregion is privately owned, the region also contains major federal and state holdings. National Forests comprise 29 percent of the region and include the Angeles, Los Padres, Cleveland, and San Bernardino National Forests. These forests contain several large wilderness, recreation and wildlife areas. Three percent of the region is managed by the Bureau of Land Management (BLM) in scattered parcels, primarily in the inland valleys. Military and Native American reservations account for another two percent, respectively. There are also several Department of the Interior land holdings in the region as well as numerous state parks and beaches (Drake et al. 1998).

Shrubland Habitats of the South Coast Bioregion

Coastal Sage Scrub

Mediterranean scrub habitats dominate the landscape of coastal, southern California. The term "sage scrub" comprises a broad category of shrubland vegetation that occurs in the region. The majority of plant species found within sage scrub communities are succulent, low growing, and summer deciduous. Sage scrub habitats include a number of sub-associations such as Venturan sage scrub, Diegan sage scrub, succulent scrub, and Riversidean alluvial fan scrub. The term chaparral has also been generically used to categorize all Mediterranean scrub types, with coastal sage scrub (CSS) a major component of this vegetation type. Though they share many structural and functional similarities, CSS and chaparral are two distinct shrubland associations in California with different species assemblages. CSS was formerly widespread throughout the Los Angeles Basin before displacement by agricultural and spreading urban development (O'Leary 1995).

CSS vegetation is dominated by a characteristic suite of shrub species in southern California and is often referred to as "soft chaparral." Typical plant species are California sagebrush, California buckwheat, *Salvia spp.* (sage), *Mimulus aurantiacus* (bush monkeyflower), and *Encelia californica* (bush sunflower). CSS primarily exists below about 914 meters (3000') and generally occupies drier sites than does chaparral. It is common primarily on western slopes above the beaches, on steep, south-facing wind-exposed slopes, and in areas where the marine layer penetrates further inland to foothills and canyons. This community receives on average about 25 – 51 cm (10-20") of annual rainfall and is rarely subject to frost conditions. Shrubs here are not completely woody and are adapted to long, dry summers. Coastal sage scrub shrubs are typically fire adapted by seed germination so that there are usually individuals of all ages present.

CSS is a naturally patchy vegetation community and the composition of CSS vegetational subcommunities may vary substantially depending on physical circumstances and the successional status of the habitat. Over a scale of several miles, it is found in diverse habitat mosaics with other ecological communities. Obligate CSS species tend to occupy areas within these habitat mosaics, rather than areas of pure, continuous CSS. Many species that depend on coastal sage scrub exhibit transitory habitat occupancy, along with short life expectancies, high potential rates of reproduction, limited home ranges, dramatic population fluctuations, and great susceptibility to local extirpation.

Chaparral

The chaparral plant community occupies dry, rocky or gravelly slopes with either light or heavy soils at an elevation generally above, but adjacent to, coastal sage scrub. It is particularly abundant in lower montane and foothill areas. The substrate is typically rockier and moister than that of coastal sage scrub. The boundary between these two plant communities is not always a clear one, and each shares many of the same species. The majority of plant growth occurs during the winter. After fires, there is a high density of spring and summer annuals until larger shrubs can recover the area. Plant species commonly found in chaparral include *Adenostema fasciculatum* (chamise), *Ceanothus spp.* (California lilac), *Arctostaphylos spp.* (manzanita), and *Cercocarpus betuloides* (mountain mahogany). CSS may convert to chaparral or grassland, depending on slope, aspect, climate, fire history, and other physical factors and biological phenomena; conversely, chaparral or grassland areas may convert to CSS.

Shrubland Avian Species Assemblages

Coastal Cactus Wrens (*Campylorhychus brunneicapillus couesi*), California Gnatcatchers (*Polioptila californica*), and Rufous-crowned Sparrows (*Aimophila ruficeps*) are bird species associated almost exclusively with coastal sage scrub and other habitats below 914 meters (3000') on the coastal side of the mountains. Bell's Sage Sparrow (*Amphispiza belli belli*) is found in both coastal sage and chaparral habitats. Other chaparral and coastal sage scrub species include Anna's Hummingbird, Costa's Hummingbird, Allen's Hummingbird, Greater Roadrunner, Western Scrub-Jay, Wrentit, California Thrasher, Spotted Towhee, California Towhee, and Black-chinned Sparrow.

Photo by Peter Knapp

A geographically isolated coastal population of Cactus Wren depends almost exclusively on coastal scrub habitat.

Shrubland Conservation

Much of the habitat of the South Coast Bioregion has been altered or lost to agricultural and urban expansion, with only 15% of the region containing intact habitat areas. In general, remaining coastal sage habitats are extremely fragmented and isolated in areas of intensive development, precluding effective dispersal of most species. Field studies suggest that isolated fragments of less than 1 km^2 (10-100 ha) will lose their native vertebrate species within a few decades (Fleishmann and Murphy 1993). Isolated canyons in southern California lose at least half of their chaparral-requiring bird species within 20 to 40 years after isolation (Soulé et al. 1988, Soulé 1991).

Isolated blocks of relatively intact coastal sage scrub occur in Camp Pendleton Marine Corps Base, the Santa Monica Mountains, the San Joaquin Hills near Laguna Beach, and Irvine Ranch in Orange County. Patches elsewhere are quite small and highly fragmented. Some scrub communities, such as Riversidian Alluvial Fan Scrub, are now confined to remnant patches along unaltered streams and washes. The Channel Islands have experienced widespread loss of original habitats and degradation from grazing and introduced species. Chamise chaparral still occurs in relatively large blocks on some inland foothills. An analysis of coastal scrub plant community conservation status suggested that more conservation planning efforts are needed in the northern part of this bioregion where purple sage (*Salvia leucophylla*) is frequently a dominant plant (Davis et al. 1994).

Much of the South Coast bioregion falls within the jurisdiction of the following multiple-species habitat conservation plans, which are currently in various stages of completion:

- Palos Verdes Habitat Conservation Plan
- San Bernardino Valley Multiple Species Plan/NCCP
- Coastal/Central Orange County HCP/NCCP
- Western Riverside County MSHCP/NCCP
- San Diego Northern County Multiple Habitat Conservation Program
- San Diego County Multiple Species Conservation Program.

These plans have been developed to resolve conflicts between development and conservation and have been driven primarily by economic and aesthetic values, rather than by science (Scott and Sullivan 2000). The best way currently to incorporate conservation science into the plans may be through the development and improvement of plans for long-term management of multi-species reserves. Such management must help mitigate problems associated with less-than-optimal reserve design, for example problems caused by habitat fragmentation and edge effects. However, coastal sage and other shrubland habitats in Ventura County fall outside the boundaries of the coastal sage scrub NCCP planning region. Thus, the loss of habitat in this part of the South Coast Bioregion is, to a large degree, unchecked.

Portfolio Sites

The following list of sites briefly describes ecologically important scrub habitat areas within the South Coast Bioregion of southern California. This list is by no means complete, but highlights some of the larger and more contiguous habitat areas that offer the greatest potential for management and conservation of shrubland habitat for birds. Sites with an active monitoring and/or management program for shrubland birds are noted, but many of these areas are not currently protected and managed for habitat and species preservation.

Los Angeles County

Whittier Narrows Area (Montebello Hills)

While primarily known for its riparian and freshwater marsh habitat, this area includes a portion of the Montebello Hills, which preserves a large population of California Gnatcatcher, Cactus Wren, and dozens of other coastal sage-restricted plants and animals. Chevron Oil currently owns this site, but the productivity of the oilfields is near the end. This site may become available for residential development in the near future.

Big Tujunga Wash/Hansen Dam Recreation Area

Sizeable area of Alluvial Fan Scrub near the base of the San Gabriel Mountains that supports populations of Lesser Nighthawk, Greater Roadrunner, Costa's Hummingbird, Cactus Wren, and Loggerhead Shrike. Area managed by the Army Corps of Engineers.

Santa Fe Dam/San Gabriel River Wash

Sizeable area of Alluvial Fan Scrub in the San Gabriel Valley that supports populations of Lesser Nighthawk, Greater Roadrunner, Costa's Hummingbird, Cactus Wren, and Loggerhead Shrike. Area managed by the Army Corps of Engineers.

San Gabriel Wilderness Area

Dense chaparral habitat is found on the lower slopes of the San Gabriel Mountains in this 14,616 hectare Wilderness, and in adjacent areas on the Angeles National Forest.

Orange County

Central Orange County region (Nature Reserve of Orange County)

In 1996, the Nature Reserve of Orange County was created through the Central-Coastal Orange County NCCP, and is made up of private, county, and state park lands. This 15,380-hectare reserve contains coastal sage scrub, chaparral, and oak woodland habitats. The reserve is actively managed to restore these habitats by The Nature Conservancy, together with California State Parks and Orange County Public Facilities & Resources Department. In addition to monitoring California Gnatcatchers and Cactus Wrens, this reserve has initiated a multi-species monitoring program that includes 10 constant-effort mist-netting stations, operated by the Institute for Bird Populations.

Starr Ranch and vicinity

Includes Starr Ranch Sanctuary (National Audubon Society), Caspars Regional Park (County of Orange) and Upper Trabuco Canyon (Cleveland National Forest, Trabuco District). Coastal sage scrub is the dominant habitat at the lower elevations and supports populations of Least Bell's Vireo and California Gnatcatcher. Starr Ranch has operated as a preserve of southern California wildlands since 1973. Recently there were 12 active research projects at Starr Ranch representing 10 different universities and public agencies. Five studies focus on plants and animals of the endangered coastal sage scrub.

Southern Orange County region

This area, extending from Chiquita Canyon in the north to the San Diego County border in the south, contains much relatively intact coastal scrub habitat. Although threatened by development, this area is home to significant populations of the California Gnatcatcher, coastal Cactus Wren, and southwestern arroyo toad. Together with the Camp Pendleton Marine base (in the south) and Cleveland National Forest (to the north), it makes up an extensive, relatively contiguous area of natural habitat with exceptionally high biodiversity values (Jasny et al. 1997, CBI 2001). This area is subject to planning through the Southern Orange County NCCP.

Whittier-Puente-Chino Hills Corridor

Covering approximately 16,190 hectares, this site is located in a range of low elevation hills on the eastern side of the Los Angeles Basin. The Whittier-Puenta-Chino Hills Corridor includes Chino Hills State Park and numerous private in-holdings. This large, contiguous area of coastal sage scrub and grasslands supports breeding populations of California Gnatcatcher, Least Bell's Vireo, Bell's Sage Sparrow, and Cactus Wren.

San Diego County

Camp Pendleton Marine Corps Base

This base represents one of the largest contiguous remaining tracts of sage scrub habitat in southern California. The very high ecological value of this land led to its designation as an Important Bird Area of California. Several distinct core populations of California Gnatcatcher and other shrubland birds occur in the area, but it receives no formal protection as an ecological reserve or wildlife refuge. Recently, residential development on the base has claimed several hundred acres of coastal sage scrub habitat (Cooper 2004).

San Diego National Wildlife Refuge (Otay-Sweetwater Unit)

All of the refuges in the San Diego Refuge Complex, managed by the US Fish and Wildlife Service (USFWS), have been designated "Globally Important Bird Areas" or IBA by the American Bird Conservancy. Located in eastern San Diego County, the Otay-Sweetwater unit presently includes about 1,215 hectares of coastal sage scrub habitat, the first installment of a planned 17,800-hectare refuge. This unit protects the largest contiguous block of coastal sage scrub in the United States and supports one of the largest assemblages of coastal sage scrub breeding birds (Least Bell's Vireo, California Gnatcatcher) in the world based on recent biological surveys of the area. This refuge represents part of the National Wildlife Refuge System's contribution to the Multiple Species Conservation Program. Biological surveys for other species are ongoing as new land is acquired. USFWS conservation easements and land acquisitions could increase the size of this refuge and link valuable habitat areas with existing protected lands.

Riverside County

Lake Matthews/Estelle Mountain

This large area of open space located in northwestern Riverside County protects significant amounts of coastal sage and grassland habitats in a highly developed area. This is a key area for conservation under the Western Riverside Multiple Species and Habitat Conservation Plan. Estelle Mountain supports large tracts of chamise chaparral and Western juniper scrub, the latter a unique habitat type restricted to the foothills of the Peninsula Ranges. Much of this land has been designated the Estelle Mountain-Lake Matthews Reserve with parcels owned by the Metropolitan Water District, the Riverside County Habitat Conservation Authority, CDFG, and BLM. This area is considered an Important Bird Area of California and supports a notable population of California Gnatcatchers (Cooper 2004).

Skinner Reservoir Area

This important area of open space located in western Riverside County is included in the Western Riverside Multiple Species and Habitat Conservation Plan. The reservoir itself is surrounded by Riversidean Coastal Sage Scrub and grassland habitats. It is contiguous with the former Johnson Ranch area, recently purchased by the Trust for Public Land, which also protects coastal sage and grassland habitats. California Gnatcatcher, Cactus Wren, and Grasshopper Sparrows are common in the scrub and grasslands surrounding the reservoir.

Motte Rimrock Reserve

This University of California Reserve lies on a broad, rocky plateau at the western edge of Perris Valley in Riverside County. Coastal and desert influences intermingle at the site, creating an unusual mix of habitats. An inland type of coastal sage scrub covers most of the reserve, with other areas supporting chaparral, coastal-desert transitional grassland, and riparian thickets. The reserve protects critical habitat for a variety of bird species, including the threatened California Gnatcatcher. Through the University of California, the Reserve

provides a site for research on avian sage scrub species, scrub habitats and instruction on the region's natural history. The Reserve's on-going monitoring programs and databases include a functional geographic information system (GIS), animal records since 1971, synoptic collections, and regular monitoring along 15 transects since 1982.

San Bernardino County

San Gabriel Front Range Alluvial Fan

This site, located at the southern base of the San Gabriel Mountains, supports intact alluvial fan scrub habitat that is threatened by rampant residential development of the region. This little-studied avian community includes a large resident population of Bell's Sage Sparrow and possibly a remnant population of California Gnatcatcher. None of this habitat is currently protected and is owned primarily by local water districts and public agencies.

Central Coast Bioregion

The bioregion extends some 483 kilometers, from just north of Santa Cruz to just south of Santa Barbara, and inland to the floor of the San Joaquin Valley. It encompasses the counties of Santa Cruz, Monterey, San Benito, Santa Barbara, and portions of Los Angeles, San Luis Obispo, Fresno, Merced, Stanislaus, and Ventura. The geography offers coastal mountain ranges including the Santa Lucia and Santa Ynez, and coastal sand dunes. Vegetation includes chaparral, coastal scrub, mixed hardwood, redwood forests and oak woodlands. Scrub communities in the region include coastal bluff scrub, coastal sage scrub, maritime chaparral, serpentine chaparral, and mixed chaparral. The Nature Conservancy (TNC) considers the Central Coast Ecoregion to be among the three most threatened ecoregions in California (TNC 1997).

The coast has a mild, seasonally moist climate suitable for agriculture as well as dense areas of coastal scrub and maritime chaparral habitat. Inland Coast Range areas are typically hotter and drier, and support extensive areas of mixed chaparral and chamise-redshank chaparral. The area is highly agricultural; however, increasing sprawl from the San Francisco Bay area and growing urban areas from the Monterey Bay area and further south threaten both agricultural lands and shrubland habitat. These habitats are threatened by altered fire regime, invasion by exotic plants, air pollution, fragmentation and inappropriate grazing. Fragmentation of remaining patches causes additional problems by increasing their vulnerability to invasion by non-native species and decreasing the feasibility of prescribed burning (TNC 1997).

Coastal Bluff Scrub
Coastal bluff scrub occurs along the coast on the immediate ocean edge of the coastal terraces. Stands are often only a few meters wide, extending from the high tide level to the edge of the terrace or cliff and corresponding to the area influenced by salt spray. It is characterized by low-growing, salt-tolerant woody plants. Coastal bluff scrub is usually adjacent to coastal scrub or coastal terrace prairie (TNC 1997).

Coastal Sage Scrub
Coastal sage scrub occurs on coastal slopes or in valleys influenced by maritime climate, primarily fog. It is the climax community on certain clay or thin, well-drained rocky substrates. It is seral to chaparral or oak woodland on other substrates (TNC 1997).

Maritime Chaparral
Maritime chaparral occurs in patches along the coast of California from San Diego to Marin County. Stands are edaphically controlled and at most localities soils are coarse-textured and derived from sandstone of various ages. At a few localities, substrate is derived from shale or igneous materials. Stands occur within the fog zone, which presumably allows them to withstand the well-drained, arid substrates that they occupy.

Before urban and agricultural development, maritime chaparral dominated sandy landscapes near the Monterey Bay, Santa Cruz Mountains, Nipomo Mesa in San Luis Obispo County and Burton Mesa in Santa Barbara County (Griffin 1976). At least 40 percent of the maritime chaparral in Santa Barbara County has been eliminated by industrial and urban development (TNC 1997).

Portfolio Sites

San Mateo County

Año Nuevo State Park

Año Nuevo State Park is part of a complex of protected lands at the base of the San Francisco Peninsula that protects some of the richest and most varied bird habitats on the Central Coast (Cooper 2004). This area has extensive coastal scrub habitat on coastal terraces. Some of this habitat is in a state of succession from farm fields, while other areas have less-disturbed shrub habitat.

Santa Cruz County

Wilder Ranch State Park/Gray Whale Ranch State Park/Coast Dairies Property

These three properties are adjacent to one another, and protect a variety of habitat types, including maritime chaparral, coastal scrub, and coastal prairie. Wilder Ranch and Gray Whale Ranch state parks extend from the coast to Ben Lomond Mountain. The Coast Dairies property, which at 2,830 hectares is the second largest piece of private oceanfront land between San Francisco and Mexico, is slated for transfer from the Trust for Public Lands to the California Department of Parks and Recreation and the BLM in 2004.

Rancho Del Oso State Park

Located at the mouth of Waddell Creek in northern Santa Cruz County, Rancho del Oso contains dense patches of coastal scrub mixed with Monterey Pine forests. Birds such as MacGillivray's Warbler breed there, along with Orange-crowned Warblers, Allen's Hummingbirds and Song Sparrows.

Bonny Doon Ecological Reserve

This reserve is managed by the California Department of Fish and Game, but is closed to the public because of the sensitive nature of the habitat. The sandy soils support maritime chaparral. Outstanding example of maritime chaparral for the subregion of Santa Cruz County (TNC 1997)

UCSC Natural Reserve

UCSC is the only University of California campus with a natural reserve on the main campus. This reserve has small areas of maritime chaparral. Although the area of the campus covered by chaparral is small, these areas may be important in terms of connectivity. These fragments provide critical chaparral habitat between Wilder/Gray Whale Ranch State Parks and Pogonip/Henry Cowell State Park. At least one area is slated for development, while the other is semi-protected by the campus's long-range development plan.

Monterey County

Garrapata State Park

This 1,165-hectare coastal park, which straddles both sides of Highway 1 just south of Carmel, contains diverse coastal habitats including approximately 80 hectares of coastal bluff scrub and adjacent coastal sage scrub (Jenson 1983, TNC 1997).

Andrew Molera State Park

The west side of the park contains extensive coastal scrub habitat and 93 hectares of coastal bluff scrub. Andrew Molera State Park supports a variety of shrubland bird species including California Thrashers and Rufous-crowned Sparrows (Jenson 1983, TNC 1997). In 1992, the Ventana Wilderness Society established a research/education center and a bird observatory (Big Sur Ornithology Lab) in the park.

Hastings Natural History Reserve

This UC Natural Reserve comprises 932 hectares in the upper Carmel Valley of Monterey County. Dense chaparral stands (*Adenostoma fasiculatum*, with some *Ceanothus* and *Arctostaphylos*) make up about 20 percent of the reserve, and are usually found on steep, south-facing slopes. Oak woodlands and mixed deciduous hardwood forest make up most of the rest of the reserve. Intensive research on birds, especially oak woodland species (Acorn Woodpeckers and Western Bluebirds), has been conducted here.

Fort Ord Natural Reserve

Located on part of the former Fort Ord Army Base in Monterey County and administered by UC Santa Cruz, this 242-hectare reserve contains both coastal scrub and maritime chaparral habitat. Preliminary bird surveys have been conducted here and some restoration of maritime chaparral is underway. Future plans for this area recommend rolling prescribed burns to help maintain seral stage and a seedbank. This reserve is the best example of maritime chaparral for subregion of Monterey County (TNC 1997).

Los Padres National Forest/Ventana Wilderness

Los Padres National Forest encompasses approximately 809,000 hectares in the coastal mountains. Both Los Padres and the Ventana Wilderness contain extensive stands of maritime and mixed chaparral. This in combination with the steep slopes, rugged terrain, and sporadic wildfires provides habitat for numerous bird species and other wildlife. Two sanctuaries have been established for the California Condor in the Los Padres National Forest: the Sisquock Sanctuary and the Sespe Condor Sanctuary.

San Benito County

Pinnacles National Monument

The Monument covers 9,700 hectares, part of which was added in 2000 by presidential proclamation. Pinnacles National Monument is the only national park area that has extensive maritime and mixed chaparral. Dry, south facing slopes consist mostly of chamise, while more moist areas are mixed chaparral. A pig fence encloses 5,665 hectares of primarily chaparral habitat, which creates research opportunities to study the effects of pigs on habitat and birds, as well as opportunities for restoration.

San Benito Mountain Wilderness Study Area

This area includes 600 hectares in the Coast Range. It is managed by the BLM, and is host to bird species such as Black-crowned Sparrow, Sage Sparrow, Mountain Quail, Grey Flycatcher, and Common Poorwill. San Benito Mountain is also the highest point in the Diablo Range.

San Luis Obispo County

Los Osos Oaks State Reserve

This 35-hectare reserve near the town of Los Osos contains coastal sage scrub, central coastal scrub, and dune oak scrub as well as ancient coast live oak forest and riparian habitat. Surrounding areas have mostly been cleared for agriculture.

Montaña Del Oro State Park

This park, located 11 kilometers south of Los Osos, includes more than 3,240 hectares of chaparral covered hills, coastal sage scrub, and coastal bluff scrub occur (Jensen 1983, TNC 1997). The park's name, "Mountain of Gold," comes from the golden wildflowers that bloom in the spring.

Santa Barbara and Ventura Counties

Vandenberg Air Force Base

This large base encompasses approximately 39,600 hectares and is located 89 kilometers south of Santa Barbara. The land contains extensive areas of maritime chaparral, as well as dune scrub and some coastal sage scrub, especially on terraces near the Santa Ynez River. Certain areas within the base have burned in the recent past, and some coastal sage scrub/chaparral habitat restoration has taken place (see http://www.laspilitas.com/sites/space.htm). Management activities include rare species inventories, sensitive habitat protection, maintenance of GIS database of rare and listed species, and endangered and threatened species monitoring, management and protection. Many species of shrubland birds breed here, including White-crowned Sparrow, Sage Sparrow, Rufous-crowned Sparrow, and Costa's Hummingbird. Adjacent land to the north of the base around Point Sal is managed by the BLM and also contains coastal shrubland habitat.

Burton Mesa Chaparral Ecological Preserve

This area encompasses 2,075 hectares, including areas of central coast maritime chaparral, coastal sage scrub, and degraded chaparral and scrub habitat with restoration potential. An estimated 63% of the site is semi-pristine to pristine maritime chaparral dominated by purissima and shagbark manzanita (*Arctostphylos purissima* and *A. rudis*) and approximately 3% is pristine coastal scrub. Unocal Oil Company deeded the land to the state in 1991. Future management plans for the site include fire management and habitat restoration (Odion et al. 1993). The area shares a border with the Vandenberg Air Force Base.

San Joaquin Valley Bioregion

A distinctive and highly threatened shrubland habitat, known as alkali desert scrub, is found in the San Joaquin Bioregion and in the southeast part of the Central Coast Bioregion. Alkali desert scrub is the characteristic shrubland of the southern portion of the San Joaquin Valley Bioregion. Alkali desert scrub vegetation found in the San Joaquin Valley and Coast Ranges has been broken down into Valley sink scrub, Valley saltbush scrub, and Interior Coast Range saltbush scrub (Holland 1986). These habitats are characterized by low shrubs, such as saltbush and iodine bush, and non-native annual grasses. In addition to supporting a number of endangered plants, mammals, and reptiles, these habitats support a distinctive bird community including the LeConte's Thrasher (a California Species of Special Concern), Loggerhead Shrike, and Greater Roadrunner.

Photo by Peter Knapp

Greater Roadrunners can be found in alkali desert scrub habitat in the San Joaquin Valley Bioregion.

This plant and animal community is threatened by habitat loss, degradation, and fragmentation due to agriculture, urbanization, oil and gas development, fire, and over-grazing. Fire typically eliminates saltbush for a decade or longer especially if the burn is large and seed sources are absent. While much of the focus of conservation in the San Joaquin Bioregion has historically been on riparian and vernal pool habitat, conservation efforts are aimed increasingly at protecting remaining upland habitats, including alkali desert scrub and grassland. Conservation priorities in this region include protecting shrubland habitat from destruction or degradation and reducing the fragmentation and isolation of habitat patches, perhaps in part through habitat restoration.

Portfolio Sites

Carrizo Plain National Monument

This large (78,250 hectare) preserve is located on the edge of the San Joaquin Valley and contains a significant amount of alkali desert scrub habitat (approximately 19% of the Monument) as well as extensive valley grasslands, California juniper woodlands, vernal pools, and alkali wetlands. It is managed by the BLM, "so that indigenous species interact within a dynamic and fully functioning system in perpetuity while conserving unique natural and cultural resources and maintaining opportunities for compatible scientific research, cultural, social and recreational activities" (www.ca.blm.gov/bakersfield/carrizoplain.html). Mapping of breeding bird distributions for the San Luis Obispo County Breeding Bird Atlas was conducted from 1989 to 1994. Breeding Sage Sparrows (*Amphispiza nevadensis canescens*) can be found here as well as LeConte's Thrashers, Lesser Nighthawks, and Greater Roadrunners. The Carrizo Plain is considered to be an Important Bird Area of California (Cooper 2004).

Lokern and Semitropic Ridge Preserves and vicinity

These smaller preserves (1,215 hectares each), in the southern San Joaquin Valley, protect valley saltbush scrub and alkali sink habitats and are managed by the Center for Natural Lands Management (CNLM) (http://www.cnlm.org/preserve.html). Since 2001, CNLM has been monitoring birds along transects in 16 experimental plots at Lokern and 6 plots at Semitropic, as part of a larger experiment to evaluate management treatments. Shrub restoration in previously burned areas may also be conducted in the future.

A collaborative, experimental study of the effects of grazing on saltbush scrub has been underway on private lands near the Lokern Preserve since 1997. Although focused on plants, small mammals, reptiles and amphibians, the study does include a bird monitoring component (for more information see www.werc.usgs.gov/sandiego/lokern/lokern.htm). However, fires occurring early in the study have reduced shrub cover in the study area and changed the composition of the bird community towards that of annual grassland.

Pixley National Wildlife Refuge

Pixley NWR protects nearly 2,430 hectares of native alkali sink scrub, grassland and riparian habitats in the southeastern San Joaquin Valley. This ecosystem is extended to the south and east by the 600-hectare Allensworth Ecological Preserve and the largely undeveloped Colonel Allensworth State Historic Park (Cooper 2004). Lesser Nighthawks are known to breed here (K. Kreitinger, pers. obs.). The refuge also supports several special status animal and plant species.

Goose Lake

Goose Lake covers approximately 2,020 hectares in the southwestern San Joaquin Valley, about 20 miles south of Kern National Wildlife Refuge (Cooper 2004). The alkali sink scrub habitat found in this area contains dense stands of iodine bush with an understory of alkali heath (*Frankenia salina*) and saltgrass (*Distichlis spicata*). This is one of the few areas on the floor of the San Joaquin Valley that supports breeding Sage Sparrows (K. Kreitinger, pers. obs.).

Bay-Delta and Klamath Bioregions

These bioregions stretch north from the San Francisco Bay area, through the Coast Ranges, to the southern Cascades and the Oregon border. The Bay-Delta Bioregion includes the San Francisco Bay area and spreads eastward to encompass the sprawling Sacramento-San Joaquin River Delta. The climate is generally mild, with regular fog on the coast, wet winters, and warm summers inland. Shrublands make up approximately 7% of the bioregion; coastal scrub occurs in a narrow band along the coast while chaparral is typically found further inland in the Coast Ranges. The Klamath Bioregion has a cooler, wetter climate and is dominated by forest habitats, with some chaparral (approximately 2.7 % of the region) occurring in drier inland areas.

Although the acreage of shrublands in these bioregions is relatively small, these habitats support a distinct assemblage of shrubland birds. Together with the Central Coast Bioregion, these regions encompass the entire range of the non-migratory subspecies of White-crowned Sparrow (*nuttalli*) and much of the range of the Wrentit. The persistence of many shrubland specialists (e.g., Sage Sparrow, Black-chinned Sparrow) in these bioregions depends on the preservation and proper management of these shrubland habitats. In these bioregions, shrublands almost always occur in a mosaic with grassland, oak woodland, and other habitats. More research into appropriate fire management is a priority in much of these regions.

Portfolio Sites

Marin County public lands

Marin County contains much protected shrubland habitat, including significant amounts of northern coastal scrub. Numerous different agencies manage these lands including the National Park Service (Golden Gate Recreation Area and Point Reyes National Seashore), Marin Municipal Water District, California State Parks, and Audubon Canyon Ranch. The National Park Service has undertaken extensive inventories of birds and is developing a monitoring plan together with the Point Reyes Bird Observatory. PRBO has also conducted long-term intensive monitoring of coastal scrub birds at its Palomarin Field Station.

East San Francisco Bay Region

An extensive array of shrubland habitats, ranging from coastal scrub to chaparral, has been set aside on the peaks and ridges east of the San Francisco Bay. Monitoring programs and management policies differ among managing agencies, which include the East Bay Regional Parks District, East Bay Municipal Utilities District (EBMUD), and Mount Diablo State Park. Public involvement will be valuable in promoting bird-friendly management of these lands. Protecting additional land to maintain connections among parks in a high priority.

Mount Hamilton Region

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 working to permanently protect key private properties that surround and connect the public lands. This provides a rare opportunity to manage chaparral habitat on a landscape scale.

Hopland Research and Extension Center

The Hopland Research and Extension Center is a 2,145-hectare University of California field station located in the foothills of the Mayacama Mountains. Current chaparral research is focusing on the effects of fire and mastication (biomass shredding) on vegetation and bird communities. This research is funded by the USDA Joint Fire Science Program and has affiliated sites at the BLM Cow Mountain Recreation Area in Lake County. More than 180 bird species have been sighted at the Hopland Center since its establishment in 1951 including breeding Wrentit, Mountain Quail, Sage Sparrow, and California Thrasher.

McLaughlin Reserve

This reserve is a recent addition to the UC Davis Natural Reserve System. It 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-hectare site, of which approximately 40 % is shrubland habitat, 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. Almost 20% of the reserve consists of serpentine mixed chaparral. Other chaparral communities include Cypress chaparral, mixed chaparral, and chamise chaparral. The reserve is surrounded by some 30,000 hectares of land managed by the US Bureau of Land Management (BLM). This area provides great opportunities to study the effects of fire on chaparral birds.

Chapter 7. Conservation Action Recommendations

This chapter provides specific recommendations for coastal scrub and chaparral habitat activities. They consider habitat protection and restoration, land management, research, and monitoring. Many of these recommendations follow those made by other organizations, or complement them. 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 analyses available and a synthesis of ecological literature on shrubland birds. 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 and monitoring in an adaptive management framework. 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 coastal scrub sites for protection and restoration.

Recommendations

1.1. Compile comprehensive GIS to facilitate prioritization of sites for protection and/or acquisition. Interface with State of California's Natural Community Conservation Program (NCCP), The Nature Conservancy, and other organizations and habitat conservation plans currently using GIS.

Identify potential sites that include a representation of diverse shrubland associations including major formations and minor associations across both north-south and coast-inland gradients. It is important to avoid a static view of vegetation because disturbed, non-shrub areas may have potential for restoration or natural recovery. Build upon existing planning efforts such as the NCCPs in southern California. Facilitate cross-referencing among vegetation classification schemes used by the various major conservation programs including the NCCPs.

1.2. Preserve the largest remaining patches in constrained areas (e.g., heavily developed coastal plain), and identify areas to enhance or restore with the goal of maintaining or creating connectivity.

Preserving the largest remaining patches in constrained areas is critical to preserve core population segments and area sensitive species. Sage Sparrow and Lesser Nighthawk are most likely to occur on large (greater than 100 ha) relatively undisturbed blocks of appropriate habitat on the coastal slope (Lovio 1996). Many species such as Sage, Rufous-crowned, Lark and Black-chinned Sparrows, as well as Western Meadowlark are sensitive to fragmentation in coastal sage scrub and show reduced abundance within 200 to 500 m of an edge (Bolger et al. 1991, Bolger et al. 1997). Potential preserves can be buffered with non-shrublands, if necessary. Some species may be more likely to recolonize larger fragments (Crooks et al. 2001).

1.3. Prioritize potential protection sites according to current indicators of avian population health.

Conservation efforts should use the most recent information regarding the quality of existing habitat and wildlife populations to prioritize the acquisition and protection of sites. Reproductive success, in particular, is an important demographic parameter that provides a "foundation" around which to build conservation programs. Standardized data collection during a single breeding season (April through July) can provide a cursory assessment of habitat quality. Multiple years of data collection provides more insight into proximal determinants of habitat quality.

1.4. Prioritize restoration/acquisition sites according to their proximity to existing high quality sites.

Restoration sites near existing high-quality sites and population sources may have a higher probability of being recolonized by locally extirpated bird species and by rare understory herb species. Research in southern California coastal sage scrub has shown that most California Gnatcatchers disperse less than four km from where they are born to where they breed as adults. Most Cactus Wrens disperse less than one km (Atwood 1998 report and Galvin 1998). However, recolonization of chaparral fragments in southern California appears to be relatively uncommon (Bolger et al. 1991, Soulé et al. 1988, Crooks et al. 2001). Also, for many species, fragment size may be a better predictor of recolonization than degree of isolation (Crooks et al. 2001).

1.5. Prioritize restoration/acquisition based on site condition, exotic plants.

Sites with established exotic understories are more susceptible to type conversion due to competitive exclusion of native species. Conversion to grass may be facilitated by grazing and fire (Minnich and Dezzani 1998). Exotics are widespread in CSS, but sites dominated by native species, or with low densities of exotic grasses should be identified for protection from disturbance. Aggressive exotics such as broom (*Cytisus* sp.) and Pampas grass (*Cortaderia* sp.) can be problematic and expensive to control in more mesic, northern CSS.

1.6. Prioritize restoration/acquisition based on surrounding land use.

Landscape-scale land use patterns may significantly affect the sustainability of coastal scrub bird populations (Stralberg and Bao 1999). Surrounding land use influences populations of predators such as domestic cats, jays, skunks, raccoons, ravens, and crows. More research is needed regarding habitat buffers and their influence on depredation rates (Kelly and Rotenberry 1993).

Photo by James Gallagher, Sea and Sage Audubon

Restoring sites near existing high-quality sites will benefit short-distance dispersers like the California Gnatcatcher.

Objective 2

Promote coastal scrub and chaparral ecosystem health (i.e., a self-sustaining, functioning system).

Recommendations

2.1. Ensure that the patch size, configuration, and connectivity of restored scrub habitats adequately support the desired populations of scrub-dependent species.

The size and connectivity of scrub habitat patches may limit bird species' occupancy and population size. A habitat patch is a contiguous area of similar vegetation, usually defined by the dominant vegetation (e.g., a mixed chaparral patch within a forested Douglas fir mosaic). Patch sizes must not fall below the minimum necessary to support populations based on:

- Territory size requirements.
- Community dynamics
- Sensitivity of some species to fragmentation and edge effects.

When determining the minimum acceptable patch size for a site, managers should consider area-sensitive species for establishing guidelines. When considering a suite of species, managers should use the species with the largest area needs (e.g., Sage Sparrow, Lesser Nighthawk) to set the minimum patch size requirement. Design corridors to connect habitat fragments according to the needs of the species with the highest sensitivity to fragmentation (Bolger et al. 2001).

2.2. Restore natural fire regimes in areas that still have potential to function within historic range of variability.

Sites that are still relatively free of exotic grasses, and far enough from urban interfaces, should be allowed to burn in order to re-establish natural fire cycles necessary in the long run for maintaining diverse structural conditions and seral stages. Fire in chaparral has been shown to play an important role in seed germination for some species (Keeley et al. 1999), and several birds are associated with recovering shrublands (e.g., Sage Sparrow, White-crowned Sparrow). However other bird species rely on late seral scrub (e.g., Gray Vireo, Wrentit). Therefore, managing for a mosaic of different-aged stands in a landscape may best support a diverse bird community. Consider elevated fire protection for key coastal scrub areas dominated by Mediterranean annual grasses, with the long-term goal of understory rehabilitation and reintroduction of fire. See also recommendations 4.1 – 4.3.

Photo by Eric Preston, ericpreston.com

White-crowned Sparrows are associated with shrublands recovering from fire.

Habitat Restoration Recommendations

Objective 3

Design and implement restoration projects that mimic the diversity and structure of natural shrubland plant communities.

Evidence suggests that birds will use restored shrubland habitat, but relatively little is known about how to best increase the value of restoration projects to shrubland birds. However, we do know that cultivated riparian restoration sites are more beneficial to birds if they mimic the diversity and structure of naturally occurring habitats (RHJV 2000), and this pattern seems likely to be true in shrublands as well. Most studies of shrubland restoration in coastal California have focused on (1) cultivated restoration in coastal sage scrub, which has increasingly taken place as a mitigation measure, and (2) the management of chaparral and coastal scrub habitats after fire. A good review of the issues can be found in Allen et al. 2000.

Recommendations

3.1. Restore both the shrub canopy and the herbaceous understory in coastal scrub habitats.

Although coastal sage scrub supports a high diversity of herbaceous plants, especially in the first seven years after a fire, many coastal sage scrub restoration efforts have focused primarily on the planting of shrub species. This is perhaps not surprising, given that restoration is often undertaken to mitigate for loss of habitat for California Gnatcatchers, which are associated with mid-fire-cycle habitat. Bowler (2000) has proposed several restoration strategies designed to emulate post-fire succession in coastal sage scrub and promote the growth of understory plants, and further research is needed to test these strategies. Ultimately, to maximize habitat and bird diversity, management should aim to restore a diversity of post-fire successional stages in preserves (Westman 1987). Also, since exotic grasses and other weeds can inhibit shrub recruitment, grass removal and weed management are crucial to restoration success (Eliason and Allen 1997, Allen et al. 2000). Organic mulch may also promote native shrub survival by immobilizing high levels of nitrogen and providing shrubs with a competitive edge over exotic annuals (Zink and Allen 1998).

3.2. Locate restoration sites strategically.

Locate coastal scrub restoration sites close to existing shrub habitat patches (both chaparral and coastal scrub). This will allow rare, native, understory herb species to invade restored sites, thus increasing the structural and floristic diversity of the habitat (Westman 1987, Bowler 1990, Allen et al. 2000). Restoration can also be used to upgrade existing, degraded stands, to create links between stands, or to create scrub habitat within cities to soften the transition between urban and natural areas. The creation of isolated habitat patches should be avoided. Highest priority for restoration also should be given to sites with relatively low levels of nitrogen in the soil, sites with a potential native seed bank, and sites where weed invasion can be kept under control (Allen et al. 2000).

3.3. Plant coastal scrub species in a mosaic pattern modeled after the spatial design of an existing healthy site with similar abiotic characteristics.

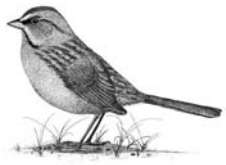
Bowler (2000) proposes that restorationists maximize the resemblance between restored and naturally occurring coastal scrub habitat by choosing a model site with similar exposure, soil, and slope. This site can then be characterized and used a model for the restoration. This method appears to be more effective at producing ecological similarity than standard approaches such as hydroseeding. This approach may lead to increased habitat diversity by taking into account factors that typically vary among sites, such as aspect, exposure, or successional stage (Bowler 2000). Maximizing habitat diversity is also likely to maximize bird diversity, given that coastal scrub bird and plant assemblages tend to co-vary (Chase et al. 2000, Rotenberry et al. 2001).

3.4. Use habitat sites that are destined to be destroyed as sources of seeds and transplants for nearby restoration sites.

Moving seeds, plants, and even soil from "doomed" development sites to restoration sites has been used to increase the success and speed of restoration in coastal sage scrub (Bowler 2000). Transplantation during the rainy season can eliminate the need for watering, thereby avoiding its negative "side-effects" (Bowler 2000, Padgett et al. 2000). Transplantation also allows for the movement of mycorrhizal fungi, epiphytes, and invertebrates to the new site and preserves local genetic structure. Transplantation of seedlings is possible for shrub species with relatively shallow roots, i.e., cacti can be moved via "callousing," and understory bulbs, grasses, lichens, bryophytes and liverworts have also been transplanted (Bowler 1994, 1999, 2000, Bowler et al. 2000). Although quantitative studies have not been published, Bowler (2000) reported that many species of native birds, including gnatcatchers, quickly use restored, transplanted habitats, including the transplanted shrubs themselves and open ground between shrubs. Any seeds used in restoration should be of local genetic stock to maximize the fitness of restored plant populations (Montalvo and Ellstrand 2000).

3.5. Seek alternatives to reseeding with ryegrass or other non-native species in post-fire management of shrublands.

Increases in erosion, sediment movement, and flooding after wildfires are natural processes in California shrublands. Due to the proximity of human development to shrubland habitats, post-fire management (including aerial and hydroseeding) has often been undertaken to try to reduce the risk of downstream floods and debris flows (Conard et al. 1995). Reseeding of burned areas is a controversial practice. Some research suggests that post-fire reseeding programs are ineffective as protection from flooding and erosion (Beyers et al. 1995, Keeley 1995b). In addition, reseeding may also cause diminished natural recovery, increased fire frequency, and harm to native plant species (Bowler 1995). Although reseeding with native vegetation is preferable to reseeding with exotics and may speed shrub regeneration (White et al. 1995), it also has limitations and drawbacks (1995b). Native reseeding should be done only with species that are appropriate to the site given its ecological characteristics (i.e., north- vs. south-facing slopes), and preferably with local seed stocks (Montalvo and Ellstrand 2000). When native shrubs are seeded, irrigation appears to have few benefits and may actually reduce survival of several species (Padgett et al. 2000). Mechanical solutions to erosion problems, such as check dams, may be more effective and less disruptive to natural ecosystem processes (Keeley 1995b; Allen et al. 2000), but these also should be implemented with care to avoid impacting sensitive resources (Bowler 1995).



Management Recommendations

Objective 4

Implement and time fire and other management activities to improve habitat quality for songbirds.

Recommendations

4.1. Increase interval between planned burns at any given site.

In every management zone or unit, provide certain stands with protection from fire for a period that will often exceed the tenures of multiple managers (i.e., indefinitely). Across management zones maintain a balance of late seral/post burn stages to accommodate all species and conditions. Shrub cover increased for up to 30 years post fire at sites in the Riverside-Perris plain (Minnich and Dezzani 1998).

4.2. Practice frequent use of fire only in protection zones adjacent to human developments.

Management plans should favor intensive fuel management in a narrower zone (e.g., near human habitation) over graded fuel reduction over a wide zone, to minimize the amount of the landscape subjected to unnaturally high fire frequencies (Keeley 2002). Distinct fuel management zones should be identified and delineated around urban interfaces. These may be managed differently than wildland areas to allow protection of human life and property (see Zedler 1995).

4.3. Limit restoration activities and disturbance events such as prescribed burns, grazing, disking, herbicide application to the nonbreeding season.

The nesting season is a critical period for the maintenance of bird populations (Martin 1993). Some management activities, such as ground preparation for planting or burning, can have serious consequences for breeding songbirds by destroying nests and nesting habitat or causing nest abandonment. Managers often have a degree of flexibility, allowing them to schedule these activities outside the breeding season while still achieving their management objectives. In general, the breeding season in coastal southern California may begin as early as February and continue through mid-August, depending on species, region, habitat type, and elevation. However, some evidence suggests that spring burns in coastal sage scrub may be more likely to promote native plant diversity than fall burns (Allen et al. 2000). Thus, the costs and benefits of spring burns must be weighed carefully on an individual site basis. Where habitat is highly degraded and lacking native fauna, the long-term benefits of spring burns may sometimes outweigh the short-term costs to breeding birds, although this needs further study.

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

Management should avoid aggregations of livestock and associated livestock facilities (e.g., corrals, pack stations, salting areas and feedlots) during the breeding season whenever possible. Livestock and associated facilities provide foraging areas for cowbirds (Mathews and Goguen 1997, Tewksbury et al. 1998) who feed in short-stature vegetation within "commuting distance" of their laying areas.

4.5. Consider elimination of livestock grazing in coastal scrub.

Thinning of CSS has been attributed to livestock grazing, which opens up the shrub canopy to invasion by exotic annuals, disseminates seeds, and reduces the ability of native forbs and perennial bunch grasses to compete with exotics (McBride 1974). Grazing in northern coastal scrub at the Point Reyes National Seashore resulted in reduced shrub cover, and reduced songbird diversity. Species such as Wrentit, Spotted Towhee, and Orange-crowned Warbler were restricted to drainages and steep slopes protected from grazing (Holmes et al. 1998).

4.6. Control and eradicate non-native plant species. Such control is best planned and implemented on a watershed scale.

4.7. Control and eradicate non-native animal species.

Feral cats are a major predator of birds and their nests. Efforts to control and eradicate feral cat populations should be undertaken where feasible. Pet cats should be kept indoors at all times.

Objective 5

Interface with planning agencies to minimize deleterious effects of future development.

Recommendations

5.1. Avoid typical development patterns of roadways following valleys or other lowlands.

Development has favored productive lowlands and coastal terraces without significant grade. This is often favored bird habitat. Consider building bridges over canyons rather than building roads along canyon bottoms to allow for connectivity.

5.2. Distinguish grasslands (in mosaics) from non-productive weedlands.

Grassland patches within shrublands, especially those containing native plants and birds, should be given higher priority for protection than patches of non-native weeds. When possible, high impact uses such as buildings and roads should occur in already impacted (e.g., weedy or barren) areas with the goal of no further fragmentation of remaining habitat.

Monitoring and Research Recommendations

Objective 6

Provide data on pressing conservation issues affecting birds.

In order to successfully protect and expand native bird populations, managers must have the most recent data available on populations and their habitat needs. Standardized scientific monitoring of populations will provide decision-makers with these essential tools.

Recommendations

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

The number of young produced in a bird population (reproductive success) critically influences a population's presence, health and sustainability in an area. Reproductive success is a primary demographic parameter that provides critical information for understanding patterns of population change. Therefore, these data can be used to understand trends, focus conservation action and funds, and identify hypotheses for further evaluation. When fewer than 20% of nestlings survive to fledge, nest success is considered poor and probably indicates a nonviable population. Monitoring annual adult survival is important in the same way as discussed for reproductive success; population trends can thus be better understood from monitoring the interaction of these demographic parameters. Survival can only be confidently calculated for adults after at least four years of mark/recapture data (such as mist-netting) have been obtained (Nur et al. 1999). Research and monitoring seeking to determine productivity for a breeding population should include at least four years of nest-searching and/or mist-netting.

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

Long-term data are vital to deciphering the difference between a true population decline and a natural fluctuation in population size. The best possible data on population trends are needed so as not to squander scarce resources on a species that is not truly in decline. Conservationists should conduct long-term monitoring at reference sites that embody the characteristics restoration efforts strive to recreate. Additionally, long-term monitoring at key experimental sites can test the assumptions that currently drive restoration and management practices.

Intensive monitoring includes collecting data on primary demographic processes and associated habitat characteristics and seeks to identify causal connections between habitat variables and species viability. Biologists collect data on reproductive success, breeding densities, parasitism, survival, vegetation data, suitable habitat requirements, and general life-history information. Conservationists can employ these data to make well-informed, adaptable management plans.

6.3. Conduct selective monitoring at critical sites to determine the effects of cowbird parasitism on the Gray Vireo, California Gnatcatcher, and White-crowned Sparrow.

Brown-headed Cowbird parasitism has potentially devastating effects on the populations of these and many other bird species in California. Habitat size, vegetation structure, and adjacent land use all influence the rates cowbird parasitism. By studying the variables involved, conservationists can better formulate landscape-level management plans to enhance bird populations. In much of southern coastal California, intensive cowbird trapping in riparian areas may have reduced cowbird parasitism rates in adjacent shrublands. Monitoring projects should take into account this pattern (perhaps focusing on areas where cowbird control has not been conducted). The effect of any cessation of intensive cowbird removal on parasitism rates of shrubland birds should also be monitored.

6.4. Conduct selective monitoring at key sites to determine the factors influencing nest success of coastal scrub- and chaparral- associated species.

Relatively recent, local extirpation and declines of these and other western species from their historical breeding range appear to be caused by low productivity. Local extirpation may signal the early stages of a process of severe population declines. By determining the factors associated with low reproductive success, research may identify which management and restoration actions will help 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 the reproductive success of key species provides gauges that allow management changes before it is too late.

6.5. Conduct research on the effects of urban/suburban edges on bird populations in habitat reserves and on methods to reduce or mitigate these effects.

Given the patterns of past and current human development, most habitat reserves are likely to be influenced to some extent by edge effects, such as edge avoidance, increased predation near edges, and human incursion leading to vegetation damage (Scott 1995, Kelly and Rotenberry 1993). Therefore, it is crucial to continue to study the mechanisms by which edges effect bird populations in order to learn how to manage reserves along the wildland/urban interface to reduce or counteract these effects.

6.6. Conduct research to identify fire prevention and post-fire management techniques that are relatively beneficial to birds.

Fire is a natural process in California shrublands, but it must be intensively managed due to past human impacts on the ecosystem. The proximity of human development, the occurrence of human-caused fire, and plant community change due to exotic species have all made fire control and post-fire management necessary. However, much more needs to be known about how to best manage coastal scrub to meet society's needs while maximizing biodiversity and bird population health. Questions include, but are not limited to: What kind of reseeding, if any, should be used after wildfire? Are prescribed burns helpful in preventing wildfire and how do they impact birds? How often should chaparral burn to provide habitat for a given species? What proportion of a landscape should be in early vs. late post-fire cycle condition to maximize avian biodiversity?

Objective 7

Maximize the effectiveness of ongoing monitoring and management efforts.

Recommendations

7.1. Develop adaptive management plans that incorporate multi-species bird monitoring for all NCCP and Multi-Species HCPs.

Natural Communities Conservation Programs (NCCP), Multi-species Habitat Conservation Plans (MSHCPs) and other development mitigation projects initiated by cities, counties, developers or other land managers (e.g., the Western Riverside County MSHCP; Sullivan and Scott 2000) should seek to incorporate long-term monitoring and current information on avian populations. Only then can the success of these programs be measured. Each multi-species habitat conservation plan should include long-term management plans using an adaptive management strategy that links monitoring to management actions (Scott and Sullivan 2000).

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

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 on local birds and their response to management activities. Managers on the preserve can quickly incorporate new data into management regimes, honing their project designs to better benefit birds.

7.3. Use standardized monitoring protocols.

By standardizing monitoring techniques, researchers ensure that results can be compared across space and time. The USDA Forest Service published guidelines for standardized monitoring techniques for monitoring birds (Ralph et al. 1993).

7.4. Maximize the cost effectiveness and value of existing specialized monitoring programs for sensitive or threatened species (e.g., those oriented toward California Gnatcatcher and Cactus Wren) by collecting standardized data on multiple species (such as point counts) in addition to any specialized protocols aimed at one species.

Many state and federally sponsored surveys only monitor special-status species. By adding a standard protocol that provides information on multiple species while conducting special-status species surveys, researchers could rapidly expand their knowledge of California's birds. Such data could be shared and analyzed and results would be added to conservation plans and incorporated into management regimes. Even if resources are not immediately available for analysis, the information will provide a baseline or historical perspective on bird distribution and abundance. To ensure their use in conservation and research, data from multi-species point count programs should be distributed via the internet to programs such as the California Partners in Flight Study Site and Species Breeding Status Database (http://www.prbo.org/calpif/maps.html) and the USGS Patuxent Wildlife Research Center's Bird Point Count Database (http://www.mp2-pwrc.usgs.gov/point//).

Chapter 8. Implementation of Conservation Plan Recommendations

The implementation plan of the Coastal Scrub and Chaparral Bird Conservation Plan is in development. It will be used to engage with local, bioregional conservation efforts and to better define bioregional priorities for acquisition, restoration, and focused-conservation efforts. Ideally, the implementation process would 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 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.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 (see Figure 2-1 for BCR boundaries). 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.

Photo by Eric Preston, ericjpreston.com

Joint Ventures, originally created to protect North America's waterfowl like this Ring-necked Duck, are now embracing the conservation of all birds.

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

Non-governmental Organizations:
California Native Grass Association
California Native Plant Society
California Cattleman's Association
Point Reyes Bird Observatory
Wildlife Conservation Society
National Audubon Society
National Fish and Wildlife Foundation
The Nature Conservancy

Federal Organizations:
USDA Forest Service
US Fish and Wildlife Service
Bureau of Land Management
Natural Resource Conservation Service
Bureau of Reclamation
US Geological Survey - Biological Resource Div.

University Organizations:
University of California Cooperative Extension
(UC-Berkeley, UC-Davis, UC-Riverside)

Private Organizations:
Certified Rangeland Managers

State of California Organizations:
California Department of Fish and Game
California Department of Forestry and Fire Protection
Resource Conservation Districts
State Park system in California
Wildlife Conservation Board

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 community groups and partners in conservation through education and outreach. 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, but are not limited to, 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.

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 work 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?

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 may encourage predation of adult birds and their nests by animals such as domestic cats, raccoons, and jays. They may alter available food resources by depleting local insects with pesticides. Finally, they may 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 shrubland 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 habitats throughout the state. (See the PRBO Conservation Science web site *http://www.prbo.org* for ways to get involved. Also, Appendices A and B provide information on bird monitoring techniques and the data each 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, scrub jays, and opossum. Increased numbers of these predators can depress bird populations.

Photo by Ian Tait

Do not supplement the diet of avian nest predators, such as this Western Scrub-Jay.

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. Nestlings require insects and other high-protein food items, 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.

Photo by PRBO Conservation Science

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.

Education Opportunities

The concepts and guidelines outlined above 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 foster interest and enthusiasm for wildlife and teach students the importance of conserving birds. The opportunity to examine birds up close (such as mist-netting demonstrations) and interact with biologists provides an invaluable experience to catch students' interests.

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

There are many excellent sources for curriculum and hands-on bird activities for the classroom. Through PRBO Conservation Science, 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 Sarah Warnock, 4990 Shoreline Hwy, Stinson Beach, CA 94970 (415) 868-1221 ext. 307, or email at swarnock@prbo.org. Each year Partners in Flight 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 the National Fish and Wildlife Foundation (NFWF). 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.

Volunteer Involvement

Using volunteers to aid in data collection and restoration is an excellent way for organizations 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.

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. 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.

NFWF 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 host a festival or fair focusing on birds. To obtain a copy contact IMBD Information at (703) 358-2318 or IMBD@fws.gov.

BOX 9-1. 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 their 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 15 cm (6") 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 many 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 in 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

General Conservation Resources

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

The Wildlife Habitat Incentives Program (WHIP)
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 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. Go to http://www.nrcs.usda.gov/ and search for "WHIP".

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 is 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, trees, scrub, 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.

Wildlands Project Conservation Planning Efforts
The mission of the Wildlands Project is to protect and restore the natural heritage of North America through the establishment of a connected system of wildlands. Current planning efforts can be found at http://www.twp.org/.

General Habitat and Restoration Resources

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 more than thirty private, state, federal, and international organizations interested in environmental protection.This site contains information on 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 and CNWCPI are both programs of the Natural Resource Projects Inventory (NRPI).

- **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.

The California Environmental Resources Evaluation System (CERES)
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
http://www.dfg.ca.gov/whdab/
California Wildlife Habitat Relationships (CWHR) is a state-of-the-art information system for California's wildlife. CWHR contains life history, management, and habitat relationship information on 675 species of amphibians, reptiles, birds, and mammals known to occur in the state. CWHR products are available for 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)
online at http://endeavor.des.ucdavis.edu/cnps/

California Native Plant Society
online at http://www.cnps.org

Education Resources

Southern California Native Plants For School Gardens
by Betsy Landis, 1999. This user-friendly book is a great resource for teachers, parents and students which details how to plan and plant a native plant garden at a school.
online at http://www.cnps.org/bookstore/index.htm

Coastal Scrub and Chaparral Resources

Ecology and Restoration of Northern California Coastal Dunes, by Pickart and Sawyer. 1998. A practical book on coastal dune restoration.
online at http://www.cnps.org/bookstore/index.htm

Gardening With A Wild Heart, by Judith Larner Lowry, 1999. Provides detailed and wonderful advice on planting native habitat in your yard. Focus on central coastal scrub plant community. online at http://www.cnps.org/bookstore/index.htm

Coastal Sage Scrub Links Webpage
This website offers links to a huge variety of informative coastal scrub websites and pages. Links are available to sites covering general coastal scrub topics, descriptions of flora and fauna, restoration, fire, mapping and GIS, related research abstracts and articles, locations of parks and preserves, and bibliographies.
http://www.csupomona.edu/~jskoga/Sagescrub/Sagescrub.html

CERES Coastal Sage Scrub Bibliography Webpage. Bibliography of conservation, restoration, and management in coastal sage scrub.
http://ceres.ca.gov/CRA/NCCP/oleary08.htm

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. Such data are necessary to determine 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 shrubland habitats or significant bird populations:

- Birds are highly visible and monitoring is cost effective.
- Birds can show relatively quick response in abundance and diversity to restored habitats (35 years).
- 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 prevent 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).

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 more than 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 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, 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.

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).